United States
Department of
Agriculture

**Agricultural
Research
Service**

ARS-62

May 1987

Insects That Attack Mesquite (*Prosopis* spp.) in Argentina and Paraguay

Their Possible Use for Biological Control In the United States

Abstract

Cordo, Hugo A., and C. Jack DeLoach. 1987. Insects That Attack Mesquite (*Prosopis* spp.) in Argentina and Paraguay: Their Possible Use for Biological Control in the United States. U.S. Department of Agriculture, Agricultural Research Service, ARS-62, 36 p.

Honey mesquite, *Prosopis glandulosa* Torrey, and velvet mesquite, *P. velutina* Wooton, are weedy, leguminous shrubs or small trees that cause great damage to the livestock industry in rangelands of the Southwestern United States and northern Mexico. These mesquites are native to North America, but the center of evolution of the genus *Prosopis* is southern South America, especially in Argentina. We traveled 81,550 km in Argentina, Paraguay, and Brazil over a 6-year period searching for natural enemies that could be used in the biological control of *Prosopis* and other weeds. Information obtained from the literature and our collections show that a total of 393 species of insects and 1 mite are now known to attack the various species of *Prosopis* in southern South America. We collected 256 species of insects and the mite on *Prosopis,* 199 of which had not previously been reported. Altogether, 77 species appear to be potentially useful for biological control, and 38 species are especially promising, meriting further study for introduction. Of these 38 species, 13 attacked seed, 2 attacked buds, 12 fed on foliage, and 11 attacked limbs or trunks. When introduced into North America, some of these species may be unable to compete with native phytophagous insects or withstand attack by native parasitoids. However, other species appear to have mechanisms for avoiding natural enemies or are from insect genera not represented in North America and thus might escape native parasitoids. Several species appear to be able to fill ecological niches that presently are at least partially vacant.

Keywords: Argentine insects, biological control, insects, mesquite, mesquite insects, *Prosopis,* rangeland weeds, rangelands, weeds

Copies of this publication may be purchased from the following:

National Technical Information Service
5285 Port Royal Road
Springfield, VA 22161

ARS has no additional copies for free distribution.

Acknowledgments

We thank the following taxonomists of the Systematic Entomology Laboratory, USDA-ARS, Beltsville, MD, for identifying the insect specimens: R.E. White (Chrysomelidae and other Coleoptera); D.R. Whitehead (Curculionidae); J.M. Kingsolver (Bruchidae and other Coleoptera); T.J. Spilman (Cerambycidae and other Coleoptera); R.D. Gordon (Coleoptera); W.A. Connell (Nitidulidae); D.C. Ferguson (Geometridae and other Lepidoptera); R.W. Hodges (Lepidoptera); R.W. Poole and E.L. Todd (Noctuidae); D.M. Weisman (lepidopterous larvae); J.P. Kramer (Homoptera); M.B. Stoetzel (Coccidae); D.R. Miller (Psyllidae); T.J. Henry and J.L. Herring (Hemiptera); C.W. Sabrosky, R.H. Foote, R.D. Gagné, F.C. Thompson, L. Knutson, and W.W. Wirth (Diptera); A.S. Menke (Cynipidae); D.R. Smith (Pergidae); S. Nakahara (Thysanoptera); and E.W. Baker (Acarina). We also thank each of these taxonomists for providing distribution and host range data for all the species and for checking the list of insect names for accuracy.

We also thank J.M. Burns (Hesperiidae), D.R. Davis (Psychidae), and R.G. Robbins (Lycaenidae) of the Smithsonian Institution, Washington, DC; W.F. Barr (Buprestidae) of the University of Idaho; G.B. Neil (Thripidae) of Indian Head, Saskatchewan; and W.L. Murphy, Biosystematics and Beneficial Insects Institute (BBII), USDA-ARS, Beltsville, MD, for coordinating the identifications. We thank Manuel Viana, Museo Argentino de Ciencias Naturales Bernardino Rivadavia, Buenos Aires, for identifying many of the Coleoptera and for providing us with names of insects collected from *Prosopis*; and Jose A. Pastrana, Inst. Patologia Vegetal, Centro Nacional de Investigaciones Agropecuarias (INTA), Villa Udaondo, Buenos Aires Province, Argentina, for identifying some of the microlepidoptera.

We thank Emilio Ulivarry, Instituto Darwinion, San Isidro, Buenos Aires Province, Argentina, for identifying the *Prosopis* plant specimens. We also thank Rosalinda Ferrer of this laboratory and Josephine Runnacles and Hector Cordo formerly of this laboratory for assisting with the field collections, rearing insects for identification, and compiling the data.

Contents

Insects That Attack Mesquite (*Prosopis* spp.) in Argentina and Paraguay

Their Possible Use for Biological Control in the United States

Hugo A. Cordo and C. Jack DeLoach[1]

Introduction

Mesquites (*Prosopis* spp.) are thorny, leguminous trees or shrubs that infest 38 million ha of rangeland in Southwestern United States (Platt *1959*) and large additional areas in northern Mexico. The most dense stands are found through central Texas between isohyets of 457 and 710 mm of annual rainfall; the northern limit coincides with a mean January temperature of 0°C (Bogusch *1951*), and the eastern distribution is probably limited by soil factors (Peacock and McMillan *1965*).

A large body of literature documents the great losses that the grazing livestock industry sustains because of mesquite competing with desirable forage plants for water (DeLoach, in press). The dense mesquite thickets also increase the cost of managing livestock. Direct losses to the grazing livestock industry were estimated at $250 to $500 million annually in the United States (plus an unknown amount in Mexico), not including the value of water lost to other agricultural, industrial, or urban uses. In the more arid areas of southwestern North America, mesquite appears to contribute to soil erosion, sand dune formation, and desertification. However, mesquite also has several beneficial values. It is used for ornamental shade trees; the pods are eaten by livestock; the wood is used for barbecue wood, charcoal, firewood, fenceposts, parquet flooring, and crafts; and the flowers are an excellent source of nectar for honey production. Present damage caused in the United States is probably 20–30 times greater than present beneficial values (DeLoach, in press).

Mesquite constitutes as much as 10 to 25 percent of the diet of seven species of small mammals and birds, especially of jackrabbits and rodents that are themselves damaging to rangelands. Among clearly beneficial species, only the Gambel quail is likely to be reduced in population by mesquite control. Intensive cultivation of mesquite has recently been suggested to produce biomass to fuel commercial electric generating plants. Also, its potential for nitrogen fixation may be of value in rangelands or in the ecosystem. Research on these aspects is in the early stages, and these potential benefits of mesquite are difficult to evaluate at this time (DeLoach, in press).

Present chemical or mechanical controls are relatively expensive because of the low value-per-acre return in this semiarid area, where 6–10 ha or more are required to produce one animal-unit (Scifres et al. *1973*). Aerial application of the herbicide 2,4,5-T was the most economical treatment in Texas, resulting in an average annual rate of return of 15.9 percent and the need for 8.5 years to recover the investment capital; the corresponding figures for the next best herbicide, dicamba, were 11.4 percent and 16 years (Whitson and Scifres *1980*). Even 2,4,5-T was not economical for light stands of mesquite, and in some areas it was economical only for dense stands on deep soils. None of the mechanical treatments resulted in the 9 percent per year return on the investment needed to break even (Whitson and Scifres *1980*). The new herbicides, triclopyr and chlorpyralid, that have replaced 2,4,5-T are more effective but are also more expensive.

In contrast, biological control by introduced foreign insects offers the prospect of permanent control and benefit-cost ratios that typically range from an estimated 50:1 to more than 1,000:1 (Andres *1977*). Although most previous attempts at biological control using foreign organisms have been directed against introduced weeds, control of the native mesquites is promising because we have found many natural enemies attacking several species of *Prosopis* in southern South America; with more testing, these natural enemies could be candidates for introduction (DeLoach *1978*, *1980*). Possible candidate insects for introduction also occur in parts of Asia on *Prosopis farcta* (Solander ex Russell) Macbride. Gerling and Kugler (*1973*) found 69 species of phytophagous insects in Israel, the most important of which were insects that fed on fruit or seed. Ward et al. (*1977*) listed 26 species of insects from *Prosopis* spp. in Asia and North Africa.

Two species of mesquite are major pests of rangelands in the United States. Honey mesquite, *P. glandulosa* Torrey var. *glandulosa*, occurs from eastern Texas to northeastern Mexico, in western Oklahoma, and in southern New Mexico; western honey mesquite, *P. glandulosa* var. *torreyana* (Benson) Johnston, occurs from western Texas to southern California; and running mesquite, *P. glandulosa* var. *prostrata* Burkart, occurs in southern Texas. The second species, *P. velutina* Wooton, is a major pest in Arizona and Sonora, Mexico. Four other species occur in Mexico, *P. laevigata* (Humboldt and Bonpland ex Willdenow) M.C. Johnston, *P. juliflora* (Swartz) DC., *P. articulata* S. Watson, and *P. tamaulipana* Burkart (Johnston *1962*, Burkart *1976*). One other species, *P. alba* Grisebach, was introduced from Argentina into the United States as an ornamental probably 20–30 years ago by unknown means. All of these species are in section Algarobia, series Chilenses, of the genus except *P. articulata* and *P. tamaulipana*, which are in series Pallidae.

In addition, three species of screwbean mesquites in section Strombocarpa occur in North America: *P. pubescens*

[1]Ingeniero agrónomo, USDA-ARS, Biological Control of Weeds Laboratory, Hurlingham, Buenos Aires, Argentina; and research entomologist, USDA-ARS, P.O. Box 6112, Temple, TX 76503-6112.

Bentham grows along streams and waterholes from western Texas to southern California and northern Mexico, *P. palmeri* S. Watson in Baja California, and *P. reptans* Bentham var. *cinerascens* (A. Gray) Burkart in south Texas and adjoining Mexico. These species are weedy only in localized areas (Johnston *1962*, Burkart *1976*, Simpson *1977*, Isley *1973*). Carman and Mabry (*1975*) suggested that the North American species came by long-range migration from South America on at least three separate occasions: (1) the ancestor of the species in section Algarobia, (2) the ancestor of the screwbeans *P. pubescens* and *P. palmeri*, and (3) *P. reptans*, possibly a recent introduction by the early European explorers.

The genus *Prosopis* has had its greatest evolutionary development in semiarid regions of southern South America, where 31 species occur, the center of diversity being in Argentina (Burkart *1976*). The South American species most similar to the North American weedy species are *P. chilensis* (Molina) Stuntz emend. Burkart, *P. nigra* (Grisebach) Hieronymus, *P. caldenia* Burkart, *P. flexuosa* DC., *P. alpataco* R.A. Philippi, *P. alba* Grisebach, and *P. pugionata* Burkart (fig. 1); all of these species are in section Algarobia, series Chilenses (Burkart *1976*).

Ward et al. (*1977*) reported 112 species of phytophagous insects, some of which had been collected in Argentina by C.R. Ward and E.W. Huddleston in the late 1960's and others of which had been documented in various museum and literature records. We conducted extensive explorations from this laboratory into Argentina and Paraguay from 1976 to 1981 to find additional insects that might be useful for biological control. Argentine scientists provided information on additional species that attack these plants.

This report presents our estimates of the abundance of the various insects we collected, their importance in damaging the plant, and their relative value for biological control.

Materials and Methods

In South America, the main area of distribution of *Prosopis* is along the semiarid eastern slopes of the Andes Mountains and in the plains to the eastward, in the Chaco and Monte phytogeographical regions of Argentina and Paraguay (Burkart *1976*, Cabrera *1976*). The elevation varies from near sea level in the south and along the Río Paraná to 3000 m in the north and west.

The climate in this area is generally similar to that of northern Mexico and the southwestern area of the United States where mesquite occurs. The western area has mostly summer rainfall; moderate to hot summers and mild to cold winter temperatures, depending on the elevation; and high annual water deficits. The climate in these areas of both North and South America belongs to world climate zones 7, 2, and 3, as described by Walter et al. (*1975*). Type 7 is the arid temperate climate of continental regions, with low rainfall and strong contrasts between summer and winter. Type 2 has a tropical-rainfall climate with prolonged droughts in winter. Type 3 is typical for the subtropical dry zone of deserts, with extreme variation between day and night and annual precipitation of less than 200 mm. In Argentina, the mesquite distribution is in areas with climates ranging from type 7 to type 2. In the United States and Mexico, the range is also from type 7 to type 2, but type 3 predominates. The contrast between summer and winter is stronger than in Argentina. Because of these differences, few areas or points in North America have climates that are closely similar to those in areas of South America; however, since the vegetational physiognomy is similar in both areas, the climatic differences probably are not critical. Thus, in a broad sense, it is possible to say that the climate of Andalgalá, Catamarca, is similar to that of Ft. Stockton, TX; that of Mendoza is similar to that of the area from El Paso, TX, to Albuquerque, NM; that of Neuquén approximately matches the climate from southwestern California to western New Mexico (Socorro); and that of Santa Rosa and Bahia Blanca is similar to that of Del Rio, TX. Visual interpolation between locations in figures 2 and 3, suggests other areas with similar climates. For example, areas of central Chaco and Formosa Provinces would be similar to areas near Saltillo and Monterrey, Mexico.

We made 13 extensive exploratory trips into western and northern Argentina and western Paraguay between 1976 and 1981, traveling a total of 81,550 km in search of insects that attack various species of *Prosopis* (fig. 4). The first trip included extensive travel in southern Brazil in search of natural enemies of other weeds, but we found no *Prosopis*.

Collections were made by sweeping, by beating onto a sheet, by hand collecting, and by collecting the fruit and limbs of host plants for subsequent emergence of insects. Immature insects, especially foliage feeders, were held in clear plastic boxes during the trips and provided with fresh leaves every few days until they pupated so that we could obtain adults for identification.

Voucher specimens of the plants and insects collected are maintained at this laboratory and at the Systematic Entomology Laboratory, USDA-ARS, Beltsville, MD.

We have ranked the more promising species for biological control into three categories based on (1) degree of host specificity, (2) abundance and amount of damage caused, (3) degree of probable competition with native insects of

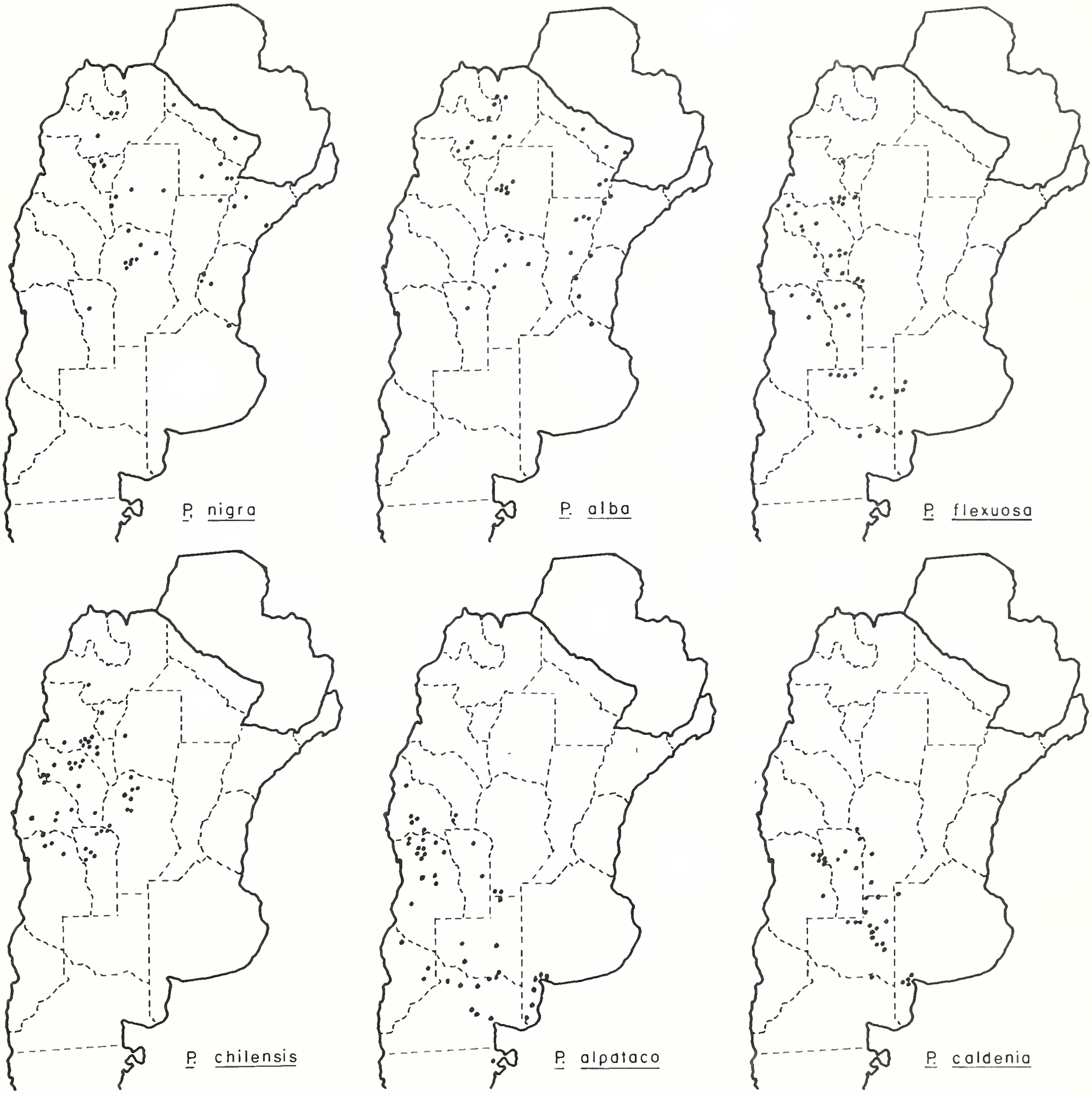

Figure 1
Distribution in Argentina of the six most abundant species of *Prosopis*, section Algarobia, series Chilenses, that are most closely related to the North American weedy species, *P. glandulosa* and *P. velutina* (information from Burkart *1976*).

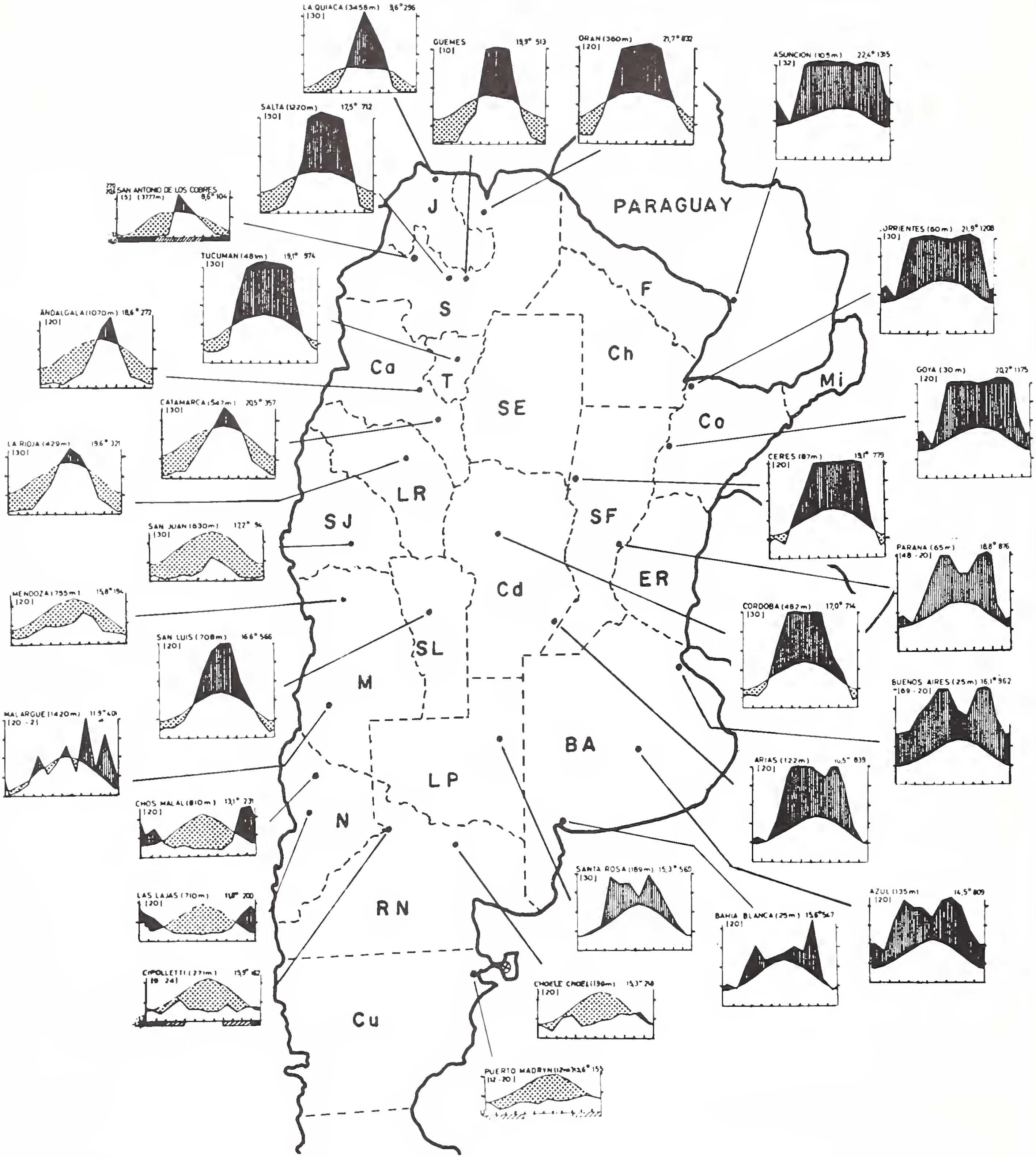

Figure 2
Climate diagrams of locations near collecting sites of *Prosopis* in Argentina and Paraguay (adapted from Walter et al. *1975*). BA=Buenos Aires, Ca=Catamarca, Cd=Córdoba, Ch=Chaco, Co=Corrientes, Cu=Chubut, ER=Entre Rios, F=Formosa, J=Jujuy, LP=La Pampa, LR=La Rioja, M=Mendoza, Mi=Missiones, N=Neuquén, RN=Rio Negro, S=Salta, SE=Santiago del Estero, SF=Santa Fe, SL=San Luis, SJ=San Juan, T=Tucumán.

Figure 3
Climate diagrams of locations in North America (shaded area) where *Prosopis* occurs (adapted from Walter et al. *1975*, Simpson *1977*, and Johnston *1962*).

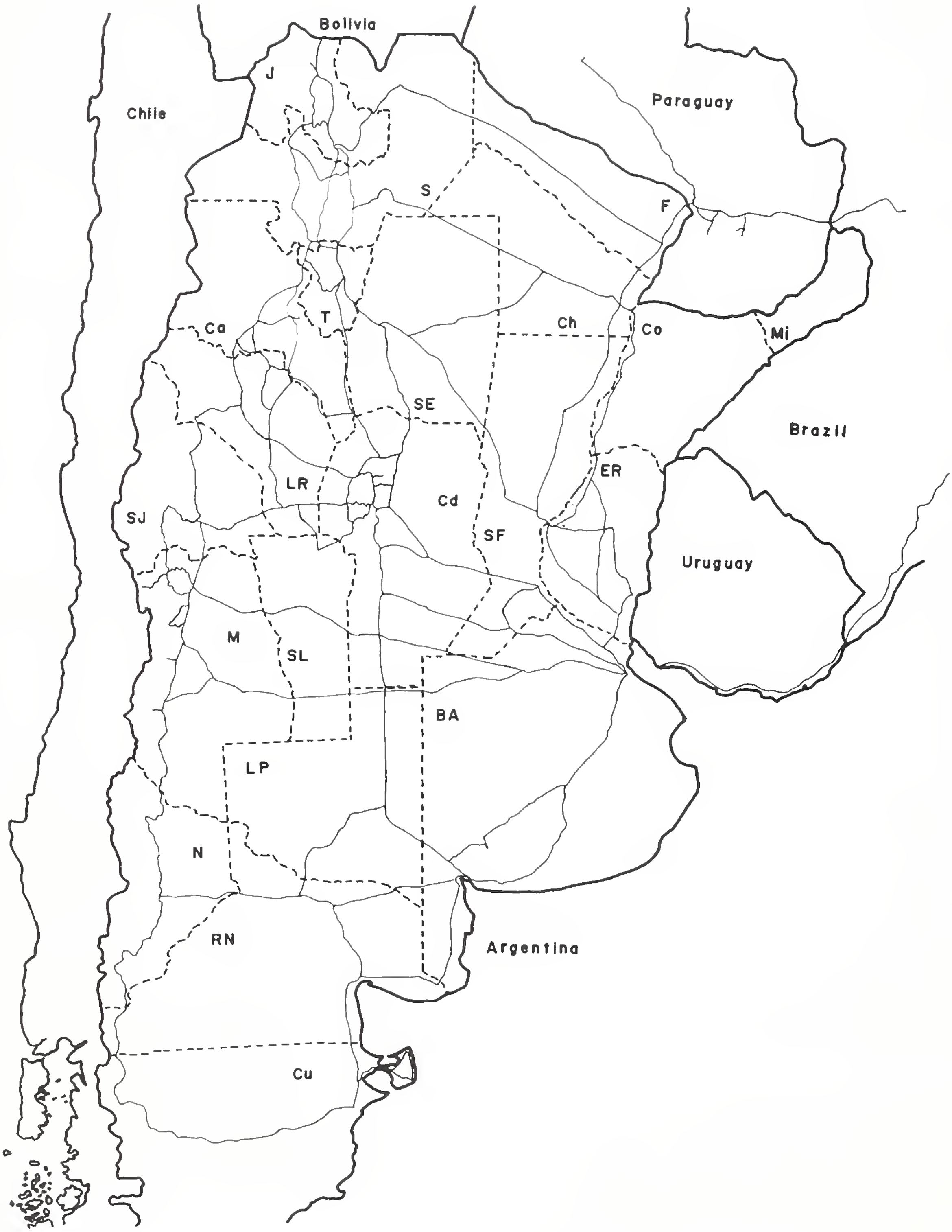

Figure 4
Routes followed by the authors in Argentina and Paraguay in search of natural enemies of mesquite, 1975–1981; province names are given in figure 1.

mesquite in North America, and (4) occurrence of other members of the insect genus in North America, which gives an indication of the probability that parasites, predators, or pathogens of native species might be able to transfer and attack the introduced species.

Results and Discussion

A total of 393 species of phytophagous insects and 1 mite species are now known to attack the various species of *Prosopis* in Argentina and Paraguay (table 1). The insects comprise 244 Coleoptera, 66 Lepidoptera, 37 Homoptera, 18 Hemiptera, 26 Diptera, 4 Hymenoptera, and 1 Thysanoptera (those identified as "spp." in table 1 being counted as 2 species). Of these, 105 had previously been reported by Ward et al. (*1977*). In addition, M. Viana provided names of 66 species of Coleoptera that attack mesquite, 41 of which had not been mentioned by Ward et al. (*1977*). Also, H. Erb (CIRPON, Tucumán, Argentina) provided names of a few species and biological information on others.

We collected 256 species from *Prosopis* in Argentina and Paraguay, 199 of which had not been mentioned by Ward et al. (*1977*), Viana, or other workers. The South American insect fauna that attacks weeds is not well known, and only 97 of the species we collected could be identified to the species level, including those labeled "near" or "probably." At least 20 new species were found, and more may be discovered as the specimens are studied in more detail.

Of the 256 species we collected, 99 species were collected at only 1 site on 1 occasion, and only 1, 2, or 3 specimens of each species were collected. We do not consider such low numbers to indicate an association with *Prosopis* or importance in control. Of the remaining, 77 of the more abundant species have been arranged in categories of probable importance in causing damage and in possible value as introductions for biological control (table 2).

Flower, Fruit, and Seed Feeders

The most desirable insects for introduction at the present time are those that attack the reproductive system of the plant. Such insects would slow or stop its spread as a weed but would not harm standing trees used as ornamentals or for other purposes.

We reared at least 14 species of Bruchidae from pods of *Prosopis* spp. in Argentina, at least 8 of which are new species recently described by Kingsolver (*1982, 1983*). Bruchids damaged (measured as exit holes in the endocarp) about one-third of the seeds of most species of *Prosopis* but notably less of *P. nigra, P. alpataco*, and the screwbean, *P. strombulifera* (Lam.) Bentham (table 3). Actual reduction in germination probably was much less than the proportion of seed damaged; we did not measure the degree of feeding on the seed itself or germination. The feeding by bruchid larvae often does not kill the seed; the embryo and a sufficient amount of the endosperm often remain to allow germination and growth of the seedling.

The genera *Rhipibruchus* (seven spp.), *Scutobruchus* (five spp.), and *Pectinibruchus* (one sp.) do not occur in North America and also appear to be restricted in host range to the genus *Prosopis* (Kingsolver et al. *1977*). *Rhipibruchus picturatus, R. prosopis, R. psephenopygus, Scutobruchus ceratioborus, S. vinalicola, S. terani, S. curtitropis*, and *Pectinibruchus longiscutus* attacked species closely related to honey mesquite. Kingsolver et al. (*1977*) reported that *Acanthoscelides* spp. "j" and "k" also attack species closely related to honey mesquite. *Acanthoscelides longiscutus* attacked screwbean species closely related to *Prosopis reptans*. *Rhipibruchus prosopis* attacked species in both sections Algarobia and Strombocarpa. According to Ward et al. (*1977*), *Scutobruchus ceratioborus* (=*A. vagenotatus*) attacks several species of *Prosopis*, but we did not find it on species in section Strombocarpa. All of these are known to attack only *Prosopis* spp. except *Scutobruchus vinalicola* that we reared also from *Acacia caven* (tables 1 and 2). In addition, Kingsolver (personal communication) stated that *Amblycerus piurae* (Pierce) from Peru and Ecuador, *A. sallaei* (Jekel) from Venezuela, and *Algarobius* n. sp. from Colombia and Venezuela all attack *P. juliflora* and appear restricted to the genus *Prosopis*. Also, *Scutobruchus gastoi* Kingsolver attacks *P. tamarugo* in Chile. Any of these species would be good candidates for introduction. Mesquite is already heavily attacked in North America by native species of bruchids, which might severely compete with South American introductions. Careful laboratory investigation might reveal, however, that they can outcompete the native species to give better control in the United States.

We collected several species of tiny weevils of the genus *Apion* on mesquite by beating and sweeping. Some of these species develop in galls of other insects, but we found one species rather heavily attacking green pods. According to Erb (personal communication), the eggs of this species are laid in the succulent, green pods just before they reach full size and before the seed begin to enlarge; the larvae feed on the seed and nearly always kill them by eating the embryos. Thus, although they are much smaller, *Apion* cause more damage than bruchids. Erb stated that in some areas more than 90 percent of the seed were destroyed, but the occurrence of damage was sporadic. Erb has collected this species of *Apion* only on three species of *Prosopis, P. alba, P. nigra*, and *P. ruscifolia* Grisebach.

The taxonomy of the genus *Apion* is poorly understood, and none of our specimens were identified to species. Ward et al. (*1977*) reported that three species of *Apion* occur on *Prosopis* in the United States and Mexico; they reared one species from galls of other insects and one probably fed on seeds. This latter species might compete with the Argentine species if introduced, but the damage we observed in Argentina was much greater than that we have observed in the United States.

We collected five species of small *Sibinia* weevils on *Prosopis* spp., three of which were new species (Clark *1979*). All probably feed on buds or seeds. *Sibinia mastuerzo* was common on *P. strombulifera* at one site and *S. tintitaco* on *P. torquata* at two sites; both would be candidates to control *P. reptans* in the United States. Only *S. concava* and *S. asulcifera* attacked species of *Prosopis* in series Chilenses, and both were scarce. Since species of this genus have not been found on mesquite in North America, they would be candidates for introduction. The amount of damage caused in Argentina has not yet been assessed.

The cerambycid *Lophopoeum timbouvae* was reported by Bosq (*1943*) to develop in the fruits of *Prosopis*, though we did not find it in our explorations. It also developed in fruit of *Enterolobium contortisyliqum*, a legume of tropical America and the West Indies but not of North America. Erb (personal communication) stated that larvae of *L. timbouvae* fed in the pods and that one larva usually killed several seeds, but the occurrence of damage in the field is localized and sporadic. We reared one species of cerambycid, *Leptostylus* prob. *phryssomimus*, from dry pods, but the species feeds only on the mesocarp of the fruit.

The pentatomid *Lobepomis peltifera* was observed feeding on green pods and probably causes considerable damage, but other species of pentatomids and coreids in Texas cause similar damage.

We reared the anobiid beetle *Tricorynus argentinus* from pods of *Prosopis*, especially of *P. caldenia*, but Viana stated that it also attacked *Cassia aphylla*. Also, Viana reported that *T. argentinus* and *T. subrutiliceps* fed on the beans of *P. alba* and *P. nigra*, but Bosq (*1943*) reported that the larvae of *T. subrutiliceps* bore in small branches. Other species of *Tricorynus* occur on mesquite in North America (Ward et al. *1977*).

We reared the pyralid *Anypsipyla univitella* from pods, particulary of *P. chilensis*, from several locations; but Costa Lima (*1968*) reported that it attacks *Enterolobium timbouva* and *Cassia brasiliensis*. Most of the pyralids are known to have wide host ranges, and some may have been contaminants in stored pods in the laboratory. Ward et al. (*1977*) reported that the lycaenid *Leptotes trigemmatus* from Chile fed on the fruit, flowers, and seed of *P. tamarugo*; and we reared a phycitid and a tortricid from pods.

The thrips, *Frankliniella rodeos*, was reported by Erb (personal communication) to cause very heavy damage to mesquite flowers. He also reported that one species of Cecidomyiidae parasitized flower buds. Thrips and cecidomyiids also attack mesquite in North America (Ward et al. *1977*).

Foliage Feeders

A few species of lepidopterous foliage feeders appear to be excellent candidates for introduction. A gelechiid leaf tier (tentatively determined as *Evippe* sp.) was abundant in Argentina and Paraguay in February and March; in March 1978 it had defoliated mesquite for many miles. R.W. Hodges (personal communication) stated that the species does not occur in North America. In Argentina, it attacked *Prosopis nigra* and *P. flexuosa*, and in Paraguay it attacked *P. affinis* Sprengel and *P. ruscifolia*. Other leaf-tying gelechiids (*Recurvaria-Aristotelia* group) were abundant on *P. alba* and *P. nigra*. We did not observe either species on other plants growing nearby.

A geometrid, *Nephodia marginata*, was reported by Hayward (*1958*) and Orfila (*1966*) to completely defoliate *Prosopis* over large areas in Argentina. No other hosts were recorded other than *Prosopis*. None of our specimens were identified as either of these species. We collected 17 species of geometrids that could not be identified, but we did not observe large-scale defoliation by any of them. We also found the geometrid *Narragodes* prob. *gyda* on *P. chilensis*, but it was not causing obvious defoliation. Cates and Rhoades (*1977*) reported that a species of *Semiothisa* attacked *P. torquata* and slightly attacked *P. chilensis* and *P. flexuosa* near Andalgalá, Catamarca Province; 32 percent of the total observations were on *Prosopis* (preference ranking=64 percent) and the rest on *Acacia* and *Cercidium*.

We observed bagworms of the genus *Oiketicus* causing severe defoliation of *P. chilensis* and *P. flexuosa* at several locations in Argentina. Ward et al. (*1977*) reported that *O. bergii* also attacked *Cassia aphylla* and that *O. westwoodii* attacked *Piptadenia cebil* and *P. communis*. None of these species occur in the United States, although other members of these plant genera do occur in the United States and Mexico. Ward et al. (*1977*) reported *O. horni* only from *Prosopis*, but we did not find it. *Oiketicus* is already represented by three species that attack mesquite in the United States and Mexico (Ward et al. *1977*) but cause litte damage.

Cates and Rhoades (*1977*) reported that three species of insects fed heavily on the foliage of *Prosopis* near Andalgalá. An undetermined species of noctuid fed entirely on *P. chilensis*, and 46 percent of the feeding of the noctuid *Melipotis bisinuata* was on *P. flexuosa* (mostly) and *P. chilensis* (preference ranking for *Prosopis* was 96 percent). Also, a sawfly, *Brachyphatnus* sp., fed entirely on *P. chilensis*.

We collected several species of chrysomelid beetles from mesquite, but none caused serious damage. Several are known to attack *Acacia caven*, and several are from genera represented on *Prosopis* in the United States. Five species of *Dachrys* and the related *Temnodachrys* and *Cylindrodachrys* are possibilities for introduction, but some of these species are known to attack other plants. The genera *Dinophtalma, Homotypus,* and *Monolepta* are not represented in the United States, and the species found in Argentina are not known to attack plants other than *Prosopis*. Viana stated that *Megalostomis* sp. nr. *consimilis* and *M. gazella* are widespread on *Prosopis*, although the latter also attacks *Acacia*. Bosq (*1943*) noted that *Ischiopachys cribripennis* is also widespread but also attacks *Acacia*.

The mite *Eriophyes* poss. *tenuis* damaged the foliage of *P. strombulifera*. Mites of this genus have a high probability of being host specific; and if species or biotypes also damage species of *Prosopis* series *Chilenses*, they would be good candidates for introduction.

Most adult Curculionidae fed on foliage but did not cause noticeable damage. The larvae of these species are probably more important as root or flower feeders; populations were usually at low levels.

We found species of Psyllidae near *Euphalerus* sp., and these were causing heavy damage to young foliage of several species of *Prosopis* at many locations in Argentina. Other species of Homoptera and Hemiptera might be good candidates for introduction, but not enough is known at present about their host ranges and effects on the plant to assess their importance. Some of these were frequently found, such as the cicadellids *Gypona paupercula, Polana obliqua*, and *Tapajosa doeringi*, and the membracids *Hebetica arechavaeleta, Smiliorachis* sp. nr. *concinna, S. proxima, Stictopelta acutula*, and *S. indeterminata*.

Branch and Trunk Borers

Several species of cerambycid beetles whose larvae bore into trunks and limbs, or that are twig girdlers, sporadically cause severe damage to *Prosopis* trees and could be good candidates for introduction when their host ranges are better known.

Both *Criodion cinereum* and *Torneutes pallidipennis* are large beetles (adults of the latter measure 7 by 2 cm) whose larvae can produce such severe tunneling in trunks that the tree dies or breaks off in the wind (Erb, personal communication); neither genus occurs in North America, but the latter also attacks *Acacia* trees. Erb has observed small outbreaks of *C. cinereum* that spread rapidly for 2 or 3 years before ceasing, probably halted by the attack of parasites. Viana (personal communication) stated that *Calocosmus morosus* bores in trunks and limbs (in large numbers according to Bosq *1943*) and that *Alphus* sp. nr. *bruchi* and *Ranqueles mus* also bore in trunks, but the latter is rare; all three apparently attack only *Prosopis*. He also stated that *C. desmaresti* bores in trunks; but it also attacks *Geoffroea, Acacia caven*, and other leguminous plants, according to Hayward (*1958*).

Four species of *Achryson* bore in limbs—*A. lutarium* in large limbs and *A. surinamum, A. undulatum*, and *A. unicolor* in smaller limbs; however, *A. surinamum* also attacks *Acacia caven* and several other plant genera and already occurs in North America. Erb (personal communication) stated that *Brasilianus lacordairei* also bores in branches, but it also attacks the unrelated red quebracho tree, *Schinopsis quebracho-colorado* Schlecht. Hayward (*1958*) reported that *Cyllene spinifera* occurred on *P. alba* and bored in branches and trunks of *P. nigra*; Viana stated that it attacks several species of *Prosopis*, but it is not known to attack species of other genera.

Viana (personal communication) mentioned that *Lochmaeocles sladeni* girdles branches up to 5 cm in diameter and that *Odontocera flavicauda* girdles smaller branches; both are known to attack only *Prosopis*, but both genera occur in North America. Two other twig girdlers, *Oncideres germarii* and *O. guttulata*, also attack *Acacia* in addition to *Prosopis*; another member of the genus, *O. rhodosticta* Bates, attacks mesquite in Texas but girdles branches only up to about 2 cm in diameter.

Eleven species of buprestid beetles are reported to attack mesquite in Argentina. We found only two species, probably because we did not sample extensively inside the limbs or trunks. Most species are reported to have hosts other than *Prosopis* and most of the genera also are represented in North America. None of the buprestids appeared to be good candidates for introduction.

Kuschel (*1945, 1950*) reported that adults of the weevils *Cratosomus attenuatus* Emden and *C. luctuosus* Emden were abundant on *P. juliflora* (?) at Cochabamba, Bolivia. We did not collect these species, and the two species *C. helleri* and *C. fasciatopunctatus*, reported from Argentina, are not specific to *Prosopis*. Species of this genus of weevils are known to be trunk borers (D.R. Whitehead,

personal communication); several species occur in Mexico, but none occur in the United States.

We also found an anthribid beetle, *Anthribus* sp., on *P. alba* in Formosa Province. Ward et al. (*1977*) and Viana report several species of bostrichid beetles from various species of *Prosopis*. Ward et al. (*1977*) found the bostrichid *Xyloprista hexacantha* on *Prosopis*, but Hayward (*1958*) reported that it damaged agricultural crops. We do not know that any of these species attack the living parts of *Prosopis* or that they damage the plant.

Root Feeders

We collected adults of many species of weevils from *Prosopis* in Argentina and Paraguay by beating and sweeping. Most were broad-nosed weevils of the genera *Naupactus, Pantomorus, Pororrhynchus,* and *Promecops*. Little is known of the biology or host range of these weevils or of the biology of the North American broad-nosed weevils that attack mesquite, though the larvae of broad-nosed weevils usually feed on the roots of plants. The taxonomy of all these genera is poorly understood, and only a few specimens could be identified to species. Several of the genera collected from *Prosopis* in Argentina are not represented in North America, and some might be candidates for introduction if more were known of the host range and biology of the larvae.

Gall Formers

On two occasions we found *P. nigra* infested by tiny cynipid wasps, probably *Eschatocerus myriadeus*, once near Tinogasta, Catamarca, and once near Juyuy. The larvae infested the branches, causing elongated galls. As the galls grew, the bark ruptured on one side, exposing a bare area of cambium tissue typically one-third or more of the circumference of the galled branch. The gall and the terminal part of the branch then died. In old damage, many emergence holes of the wasps dotted the exposed, dead cambium layer of the gall. At both locations, a few trees were heavily attacked, with many dead branches, but nearby trees were not infested. Similar damage was reported by Jörgensen (*1916*).

We also found several species of *Prosopis* heavily infested with a variety of galls on the stems, petioles, and thorns. These galls seemed to cause little harm to the tree, and we did not obtain specimens of the organisms causing the galls. Jörgensen (*1916*) described the kinds of galls made by several species of Hymenoptera, Diptera, Lepidoptera, and Coleoptera in *P. alpataco, P. alba, P. torquata,* and *P. campestris*. No species of the cecidomyiid genus *Liebeliola, Neolasioptera, Rhopalomyia,* or *Tetradiplosis* listed in table 1 are known from *Prosopis* in North America (R.D. Gagné, personal communication).

Considerations in Control of Mesquite

Our discussion has thus far indicated that several South American insects are promising candidates for introduction. They include foliage feeders, borers of woody plant parts, and feeders of fruit and seed. The effectiveness of introduced control agents can be estimated only broadly before releases are actually made. Moreover, some limiting factors may be more serious in a project to control a native weed (such as mesquite) than in previous projects to control introduced weeds (DeLoach *1978*). First, parasites, diseases, or predators already present in the United States on other insects might attack the species introduced to control mesquite and reduce their effectiveness. This is especially true for stem-boring larvae whose parasites are often not limited to a given species or even a genus but are more likely habitat specific (P.M. Marsh, Syst. Ent. Lab., USDA–ARS, Beltsville, MD, personal communication). On the other hand, if phytophagous organisms are introduced without their own natural enemies, they would be expected to increase to a higher level and give better control than in Argentina.

Second, mesquite in North America already has a complement of native insects that have evolved with it. Most introduced insects, therefore, will not be filling an empty ecological niche and may face competition from insects already present. Of course, some introduced species might find empty niches or might win the competition and produce better control than the native species.

Third, the control agents cannot be expected to limit their attack to only the two weedy target species, since they were collected from a different species of mesquite in South America (the North American species of mesquite, except for *P. reptans*, do not occur in South America). At this stage of the investigations, we cannot predict the degree to which a candidate insect would attack the target species (*P. glandulosa* and *P. velutina*) or species of *Prosopis* that are not primary targets. However, previous work indicates that many insects that feed on species in section Algarobia do not feed on species in section Strombocarpa (DeLoach *1982, 1983*). Careful testing would be required, of course, before the release of any South American insects to determine the degree of feeding that might occur on other species of *Prosopis*.

Some investigators have recently questioned the propriety of attempting biological control of native plants, especially species such as mesquite that are dominants in certain biomes. Ecological conflicting interests arise in the belief that all elements of an ecosystem are interrelated and that removal of a plant species from an area, especially a native species, will trigger some unknown or unwanted reaction (Andres *1981*). Johnson (in press), analyzed the effects of several drastic reductions in plant abundance

(both native and introduced plants) caused by accidental introductions or biological control agents. He concluded that the ecosystem is very strong and resilient and that ecosystem function is unlikely to be affected to any important extent by changes in species composition. He stated that the prevailing views of plant ecologists today are more in line with the individualistic concept of plant community structure than with the theory of a delicately balanced, all-parts-essential, ancient-in-age climax vegetation. He cautioned that the attempted biological control of a native weed species should include detailed and careful analyses of the benefits and losses that would arise both in regards to human use of the plant and to specific aspects of the plant and animal communities. These losses could be drastic, even though general ecosystem harm was not anticipated.

A level of control sufficient to return mesquite to its original density of the early 1800's would appear to be ecologically desirable and acceptable to the livestock industry as well. Just how much reduction would be required to achieve original densities is a matter of conjecture, because original densities are not known. However, we can probably assume that a 75–80 percent reduction in present stands would not be too much. Biological control is unlikely to achieve a reduction greater than this, especially with the introduction of only one or two insect species; additional species could be introduced later if additional control were desired.

Integrated Control Measures

Less than complete control by an introduced insect or pathogen might be satisfactory if its use is integrated with that of other control methods. Even moderate suppression of seedlings might greatly reduce the rate of invasion if coupled with supression achieved by proper grazing management that allows strong competition from grasses. Partial control that slowed the rate of reinfestation so that chemical or mechanical controls need be repeated only each 15 years instead of the present 7–8 years would be very beneficial.

An introduced control agent is unlikely to reduce stands in areas where mesquite has recently invaded and leave the original areas untouched. Also, such an agent is unlikely to kill trees in pastures and not harm trees desired for shade or ornamentals. However, some degree of selection can be made depending on which control agent is used. For example, insects that feed on flowers, seed, or small plants would reduce the spread of mesquite into new areas but would not harm shade trees or several other beneficial uses of mesquite. Seed-feeding insects of long-lived perennial plants have long been considered to be ineffective biocontrol agents (Huffaker *1959*). However, Harley (in press) discussed the use of flower- and seed-feeding insects to control woody weeds. Also, the introduced shrub *Hakea sericea* has recently been controlled by an introduced seed-feeding weevil in South Africa (Nesser and Kluge, in press). We found several species of insects in South America that attack only flowers, fruit, or seed, but we found none that attack only young plants. Chemicals or other controls to protect nurseries or other desirable plantings from introduced insects could be developed before the release of those insects.

Conclusions

Several species of insects from Argentina and Paraguay severely damage species of *Prosopis* that are closely related to the North American weedy species. They comprise two species of still unidentified gelechiid leaf tiers, two species of geometrids, a sawfly, and one or more species of psyllids, all of which feed on foliage; several species of cerambycids whose larvae bore in branches or trunks or girdle large limbs, and a tiny cynipid wasp that attacks the limbs; and several species of bruchid beetles, small weevils of the genera *Apion* and *Sibinia*, a few cerambycids, and a few lepidopterous larvae that feed on the fruit and seed. These species would appear to give substantial control of mesquite if introduced into North America. Before any of these can be introduced, however, careful laboratory testing must be carried out to determine the degree of feeding likely to occur on the target species and other related species of *Prosopis* and to assure that beneficial plants will not be damaged. Additionally, conflicts of interest between groups who regard mesquite as harmful and want it controlled (Scifres et al. *1973*) and groups who regard it as beneficial and do not want it controlled (Parker *1982*) must be resolved (DeLoach, in press). Also, Mexican approval will be required for the release of any insects. Mesquite occurs in much of northern Mexico; and any insects released in the United States would likely spread into Mexico, where biological control would pose similar conflicts of interest as those in the United States (DeLoach et al., in press).

References

Andres, L.A.
1977 The economics of biological control of weeds. Aquatic Bot. 3: 111–123.

Andres, L.A.
1981 Conflicting interests and the biological control of weeds. p. 11–20 *In* E.S. Delfosse (ed.), Proc. V Internat. Symp. Biol. Control Weeds, 22–29 July 1980, Brisbane, Australia. 649 p.

Biezanko, C.M. de, A. Ruffinelli and C.S. Carbonell.
1957 Lepidoptera del Uruguay, lista anotada de especies. Revista de la Facultad de Agronomia, Montevideo. No. 46. 149 p.

Bogusch, E.R.
1951 Climatic limits affecting distribution of mesquite *(Prosopis juliflora)* in Texas. Texas J. Sci. 4: 554–558.

Bosq, J.M.
1943 Segunda lista de coleópteros de la República Argentina, dañinos a la Agricultura. Ministerio Agricultura de la Nación, Direccion Sanidad Vegetal, Buenos Aires. 80 p.

Burkart, A.
1976 A monograph of the genus *Prosopis* (Leguminosae subfam. Mimosoideae). J. Arnold Arboretum 57(3/4): 217–525.

Cabrera, A.L.
1976 Enciclopedia Argentina de agricultura y jardineria. Regiones Fitogeograficas Argentinas 2(1): 85 p.

Carman, N.J., and T.J. Mabry.
1975 Disjunction of *Prosopis reptans* and the origin of the North American populations. Biochem. Syst. 3: 19–23.

Cates, R.G., and D.F. Rhoades.
1977 *Prosopis* leaves as a resource for insects. p. 61–83. *In* B.B. Simpson (ed.), Mesquite, its biology in two desert scrub ecosystems. Dowden, Hutchinson, and Ross, Inc., Stroudsburg, PA. 250 p.

Clark, W.E.
1979 Taxonomy and biogeography of weevils of the genus *Sibinia* Germar (Coleoptera: Curculionidae) associated with *Prosopis* (Leguminosae: Mimosoideae) in Argentina. Proc. Entomol. Soc. Wash. 81: 153–170.

Costa Lima, A.M.
1968 Quarto catalogo dos insectos que vivem nas plantas do Brasil. Brasil Min. Agric. Lab. Central Pathol. Vegetal., Rio de Janeiro, G.B.

DeLoach, C.J.
1978 Considerations in introducing foreign biotic agents to control native weeds of rangelands. p. 39–50. *In* T.E. Freeman (ed.), 4th Internat. Symp. Biol. Control of Weeds, Aug. 30 to Sept. 2, 1976, Gainesville, FL.

DeLoach, C.J.
1980 Prognosis for biological control of weeds of southwestern U.S. rangelands. p. 175–199. *In* E.S. Del Fosse (ed.), Fifth Internat. Symp. Biol. Control of Weeds, July 22–29, 1980, Brisbane, Australia.

DeLoach, C.J.
1982 Biological studies on a mesquite leaf tier, *Tetralopha euphemella*, in central Texas. Environ. Entomol. 11: 261–267.

DeLoach, C.J.
1983 Field biology and host range of a mesquite looper, *Semiothisa cyda* (Lepidoptera: Geometridae), in central Texas. Ann. Entomol. Soc. Am. 76: 87–93.

DeLoach, C.J.
(In press)
Conflicts of interest over beneficial and undesirable aspects of mesquite *(Prosopis* spp.) in the United States as related to biological control. *In* E.S. Delfosse (ed.), Proc. Sixth Internat. Symp. Biol. Control of Weeds, Aug. 1984, Vancouver, Canada. Agric. Can.

DeLoach, C.J., P.E. Boldt, H.A. Cordo, and others.
(In press)
Weeds common to Mexican and U.S. rangelands: proposals for biological control and ecological studies. Proc. Symp. Management and Utilization of Arid Land Plants, Saltillo, Coah., Mexico, February 18–22, 1985.

Gerling, D., and Kugler, J.
1973 Evaluation of enemies of noxious plants in Israel as potential agents for the biological control of weeds. U.S. Dept. Agric., P.L. 480. Final Tech. Rept. 241 p. (mimeo.)

Harley, K.L.S.
(In press)
Suppression of reproduction of woody weeds using insects which destroy flowers or seeds. *In* E.S. Delfosse (ed.) Proc. Sixth Internat. Symp. Biol. Control of Weeds, Aug. 1984, Vancouver, Canada. Agric. Can.

Hayward, K.J.
1958 Insectos tucumanos perjudiciales. Rev. Indust. Agric. de Tucumán. 42: 101 p.

Huffaker, C.B.
1959 Biological control of weeds with insects. Annu. Rev. Entomol. 4:251–276.

Isley, D.
1973 Leguminosae of the United States: I. Subfamily Mimosoideae. Mem. New York Botan. Garden 25: 1–152.

Johnson, H.B.
(In press)
Consequences of species introductions and removals on ecosystem function—implications for applied ecology. *In* E.S. Delfosse (ed.), Proc. Sixth Internat. Symp. Biol. Control of Weeds, Aug. 1984, Vancouver, Canada. Agric. Can.

Johnston, M.C.
1962 The North American mesquites *Prosopis* Sect. *Algarobia* (Leguminosae). Brittonia 14: 72–90.

Jörgensen, P.
1916. Zoocecidios Argentinos. Physis: Revista de la Sociedad Argentina de Ciencias Naturales 2: 349–365.

Kingsolver, J.M.
1968 A new genus of Bruchidae from South America, with the description of a new species. Proc. Entomol. Soc. Wash. 70:280–286.

Kingsolver, J.M.
1982 Taxonomic studies in the genus *Rhipibruchus* Bridwell (Coleoptera: Bruchidae), with descriptions of four new species. Proc. Entomol. Soc. Wash. 84: 661–684.

Kingsolver, J.M.
1983 A review of the genus *Scutobruchus* Kingsolver (Coleoptera: Bruchidae), with descriptions of four new species, and new synonymy. Proc. Entomol. Soc. Wash. 85: 513–527.

Kingsolver, J.M., C.D. Johnson, S.R. Swier, and A.L. Teran.
1977 *Prosopis* fruits as a resource for invertebrates. p. 108–122. *In* B.B. Simpson, (ed.), Mesquite, its biology in two desert scrub ecosystems. Dowden, Hutchinson, & Ross, Inc. Stroudsburg, PA. 250 p.

Kuschel, G.
1945 Aportes entomologicos (II) (Coleop. Curculionidae). Rev. Soc. Ent. Argentina 12:359–381.

Kuschel, G.
1950 I. Nuevos Curculionidae de Bolivia y Peru. II. Notas a algunas especies de Brethes (ap. 7 de Col. Curcul.). Rev. Mus. de la Plata 6:69–116 + 3 plates.

L'Argentier, S.M. de, and J.M. Kingsolver.
1984 *Rhipibruchus jujuyensis,* nueva especie de Bruchidae (Coleoptera) para la República Argentina. Acta Zool. Lilloana 38:35–39.

Nesser, S. and R.L. Kluge.
(In press)
A seed feeding insect showing promise in the control of a woody, invasive plant: the weevil *Erytenna consputa* on *Hakea sericea* (Proteacea) in South Africa. Proc. Sixth Internat. Symp. Biol. Control Weeds, Vancouver, Canada, Aug. 1984. Agric. Can.

Orfila, R.N.
1966 La isoca cuarteadora del algarrobo. Inst. Patal. Vetetal. Hoja Inf. 5:2. (Cited by Ward et al. *1977*).

Parker, H.W. (ed.).
1982 Mesquite utilization—1982. Symp. Mesquite Utilization, Texas Tech Univ., Lubbock, Oct. 29 to 30, 1982, p. A1–V9.

Peacock, J.T., and C. McMillan.
1965 Ecotypic differentiation in *Prosopis* (mesquite). Ecology 46: 35–51.

Platt, K.B.
1959 Plant control—some possibilities and limitations. J. Range Manage. 12: 64–68.

Scifres, C.J., R.W. Bovey, C.E. Fisher, and others (eds.).
1973 Mesquite: growth and development, management, economics, control, uses. Res. Mono. 1. Texas A&M Univ. and Texas Agric. Exp. Stn., College Station, TX. 84 p.

Simpson, B.B. (ed.).
1977 Mesquite, its biology in two desert scrub ecosystems. Dowden, Hutchinson, & Ross, Inc. Stroudsburg, PA. 250 p.

Walter, H., E. Harnickell, and D. Mueller-Dumbois.
1975 Climate-diagram maps of the individual continents and the ecological climate regions of the earth. Springer-Verlag, New York. 36 p. + maps.

Ward, C.R., C.W. O'Brien, L.B. O'Brien, and others.
1977 Annotated checklist of New World insects associated with *Prosopis* (mesquite). U.S. Dept. Agric., Agric. Res. Serv. Tech. Bull. No. 1557. 115 p.

Whitson, R.E., and C.J. Scifres.
1980 Economic comparisons of alternatives for improving honey mesquite-infested rangeland. Texas Agric. Exp. Stn. Bull. B-1307. 185 p.

Table 1
Phytophagous insects collected from *Prosopis* spp. in Argentina and Paraguay from 1976 to 1981, and reported by other workers

		Prosopis species and No. of insects collected[2]																
		Series Chilenses																
Insect name	**Data source[1]**	***nigra***	***alba***	***chilensis***	***flexuosa***	***alpataco***	***caldenia***	***affinis***	***ruscifolia***	***strombulifera***	**Other named species[3]**	**Un-ident. spp.**	**Host species in other genera[4]**	**Abundance (No. insects/ collection method)[5]**	**No. sites where coll.**	**Country and No. of Prov. where collected[6]**	**Attack site or mode**	**Stage coll.[7]**
Coleoptera																		
Alleculidae																		
Lobopoda sp.	W		X													Arg		
Anobiidae																		
Petalium sp.	CD	2												2/150sw	1	Arg-1		A
Tricorynus argentinus (Pic)	CD	1					10			2				11/3h, 1/150sw	5	Arg-5	Fruit	L,P,A
	V	X	X										*C. aphylla*			Arg-7	Fruit	
T. subrutiliceps (Pic)	B,W,V	X	X									X				Arg-5	Fruit	
T. sp. a	CD		2											1/3b,1/100sw	2	Arg-1,Par		A
T. sp. b	CD						1			3			*A. caven*	4/2h	2	Arg-2	Seed	L,P
Anthicidae																		
Anthicus sp.	W											X				Arg		
Anthribidae																		
**Anthribus* sp.	CD		11											1/1h	1	Arg-1	Twig gall	L
Piesocorynus or nr.	CD		1											1/50 sw	1	Arg-1		A
Bostrichidae																		
Micrapate wagneri Lesne	H,V	X											*Gossypium*			Arg-3	Trunk	
M. sp.	V							X				X				Arg-1	Dead trunk	
Tetrapriocera defracta Lesne	V	X						X								Arg-2,Par, Braz	Cut branch	
Xylobiops spp.	W											X				Arg,USA	Dead wood	
**Xyloprista hexacantha* (Fairm.)	H,W,V	X	X				X	X				X	*Eucalyptus* spp., other hosts			Arg-12	Branch	
Bruchidae																		
Acanthoscelides longiscutus (Pic)	CD				1		3			286				5/100sw, 281/4h	7	Arg-4	Seed	L,P,A
	B,H,K, W,V									X						Arg-6,Bol	Seed	
A. sp. j (undescribed)	K						X									Arg	Seed	
A. sp. k (undescribed)	K	X														Arg	Seed	
A. spp. (undescribed)	CD	15	4			5					*arg*-1		*Lippia*, *Aloysia*, *A. caven*	25/1120sw	12	Arg-4		A

*Pectinibruchus longiscutus Kingsolver	CD				13	2	11							26/4h	7	Arg-2	Seed	L,P
	K,W,	X									*pan*	X				Arg		
*Rhipibruchus atratus Kingsolver	CD		1		1		1				*toq*-8			11/6h	5	Arg-4,Par	Seed	L,P
	K	X	X		X		X		X		*toq,abb*					Arg-7,Par		
R. jujuyensis L'Argentier and Kingsolver	K										*fer*					Arg-1	Seed	A,L
**R. oedipygus* Kingsolver	K										*kun*					Arg-4	Seed	
**R. picturatus* (Fahr.)	CD		2	2	15		3				*toq*-1			23/8h	6	Arg-6	Seed	L,P
	B,K, W,V	X	X	X	X		X	X		X	*ela, hum, toq, fer*					Arg-9,Chi Col, Uru	Seed	
**R. prosopis* Kingsolver	CD			2		12				13				27/10h	4	Arg-3	Seed	L,P
	K,W	X		X		X		X		X	*jul, ser, cal, kun*					Arg-7	Seed	
**R. psephenopygus* Kingsolver	CD			5		1	12				*toq*-3			17/5h, 3/5b	8	Arg-4	Seed	L,P,A
	K	X	X	X	X	X	X				*jul, toq*					Arg-9, Bol		
**R. rugicollis* Kingsolver	CD										*kun*-1			1/0.5h	1	Arg-1	Seed	L
	K										*kun, ser*					Arg-3		
**Scutobruchus ceratioborus* (Philippi) (=*Acanthoscelides vagenotatus*=*Bruchus vagenotatus* Pic.)	CD		2	11	5		85				*toq*-8			111/10h	7	Arg-5	Seed	L,P
	K,B, V,W	X	X	X	X	X	X	X	X	X	*toq, abb, jul, rep, ser*	X				Arg-9, Chi Ecu, Par	Seed	
**S. curtitropis* Kingsolver	CD		4	5										9/4h	2	Arg-2	Seed	L,P
	K	X	X	X	X											Arg-3	Seed	
**S. ferocis* Kingsolver	CD										*fer*-10			10/1h	1	Arg	Seed	L,P
	K										*fer*					Arg	Seed	
**S. terani* Kingsolver	CD					83					*arg*-8			91/6h	4	Arg-2	Seed	L,P
	K			X	X	X					*arg, abb*					Arg-3	Seed	
**S. vinalicola* Kingsolver	CD	138	50	16	14	2	89	1		3	*abb*-6, *toq*-17	57	*A. caven*	378/24h, 4/8b	20	Arg-7,Par	Seed	L,P,A
	K	X	X	X	X	X	X	X	X	X	*has, toq, abb, ela, has, vin*					Arg-10,Par	Seed	
**S.* sp. prob. *vinalicola*	CD								8					8/1h	1	Par	Seed	L,P
Stator maculatopygus var. *tigrensis* (Pic)	CD											1		1/50h	1	Arg-1	Seed	A
S. sp. v	CD					3						1	*A. caven, A. furcatispina, A.* sp.	4/1h	2	Arg-4	Seed	L,P
Buprestidae																		
Agrilus sp. *a*	CD	3					1	1					*Gutierrezia, Aloysia*	5/350sw	5	Arg		A
A. sp. b	CD			3									*A. caven*	3/200sw	2	Arg		A
A. spp.	W		X				X				*gld*					Arg,Mex,USA		

See footnotes at end of table.

Table 1
Phytophagous insects collected from *Prosopis* spp. in Argentina and Paraguay from 1976 to 1981, and reported by other workers—Continued

Insect name	Data source[1]	Prosopis species and No. of insects collected[2]: Series Chilenses: *nigra*	*alba*	*chilensis*	*flexuosa*	*alpataco*	*caldenia*	*affinis*	*ruscifolia*	*strombulifera*	Other named species[3]	Un-ident. spp.	Host species in other genera[4]	Abundance (No. insects/ collection method)[5]	No. sites where coll.	Country and No. of Prov. where collected[6]	Attack site or mode	Stage coll.[7]
**Chalcopoecila ornata* (Gory)	V	X	X										*A. caven*, *Larrea* sp.			Arg-6	Living wood	
Chrysobothris furcata Kerr.	V	X						X								Arg-2	Dead wood	
**Paracuris bimaculata* (Gory)	V	X	X													Arg-6		A
Psiloptera corynthia (Fairm.)	H,W,V	X	X									X	*C. aphylla*			Arg-6	Branch, trunk	
P. desmaresti Thoms.	B,H, W,V	X	X									X	*C. aphylla*			Arg-6	Branch, trunk	
P. esterensis Obenberger	B,W,V	X	X									X				Arg-4	Branch, trunk	
P. plagiata (Gory)	B,W,V	X	X									X	*A. caven*			Arg-8,Chi	Branch, trunk	
P. tucumana (Guer. & Perch.)	B,H, W,V	X	X									X	*A. caven*, *Condalia*, *Gossypium*			Arg-9	Branch, trunk	
Cerambycidae																		
Achryson lutarium Burm.	B,W,V	X	X									X				Arg-11,Uru, Braz,Par	Large branch	
†*A. surinamum* (L.)	B,H, W,V	X	X								*jul*	X	*Celtis*, *Nectandra*, *Robinia*,*A.* spp., *A. caven*, *Tamarindus*, *Ficus*, others			Arg,C.Am.,S. Am.,Mex, USA	Branch	
A. undulatum Burm.	B,W,V	X	X					X				X				Arg-9,Uru	Branch	
A. unicolor Bruch	B,W,V	X	X									X				Arg-10,Uru	Branch	
**Alphus bruchi* Melzer	V	X						X								Arg-6	Trunk	
A. sp. nr. *bruchi* Melzer	CD							1						1/3b	1	Par		A
**Brasilianus lacordairei* Gahan	CL,E,H											X	*Schinopsis* spp.			Arg,Braz	Branch	
**Calocosmus desmaresti* (Guer.)	B,W, V,H	X	X				X					X	*A. caven*, *Geoffroea*			Arg-9,Bol, Peru	Branch, trunk	
**C. morosus* White	B,CL, W,V	X	X									X				Arg-7,Bol, Braz,Peru	Branch, trunk	
**Coremia* sp.	W								X							Arg		
**Criodion cinereum* (Olivier)	E											X				Arg	Trunk	
**Cycnoderus* sp.	CD			1										1/100 sw	1	Arg-1		A
**Cyllene spinifera* Newman	B,H, W,V	X	X			X	X	X				X				Arg-11,Uru, Chi	Branch, trunk	

**Leptostylus* prob. *phryssomimus* Bates	CD	3			8		3		14/4h	4	Arg-2,Par	Seed	L
L. phryssomimus Bates	CD						25		25/2h	1	Arg-1	Seed	L,P
L. sp.	CD						1					Fruit	L
Lochmaeocles sladeni (Gahan)	V						X					Girdle branch	
**Lophopoeum timbouvae* Lameere	B,V,W		X			*kun*	X	*Enterolobium*				Arg-5,Par, Braz	Fruit
L. sp.	CD				1				1/0.5h	1	Par	Seed	L
Odontocera flavicauda Bates	V	X									Arg-2,Par, Braz,Uru	Girdle branch	
Oncideres germarii Thoms.	B,W,V	X	X				X	*A. caven, A. aroma, Albizia, Piptadenia*			Arg-12,Uru, Braz	Girdle branch	
O. guttulata Thoms.	CD	2				3		*A. caven*		3	Arg-2	Girdle branch	A
	B,W,V	X	X					*A. dealbata, A. caven, Gossypium, A.* spp. *Piptadenia*			Arg-10,Uru	Girdle branch	
O. sp.	W			X							Arg	Stem	
**Ranqueles mus* Gounelle	B	X									Arg-4	Living trunk	
Rhopalophora iridipennis (Chevr.)	V	X			X						Arg-4		
**Torneutes pallidipennis* Reiche	B,V				X			*A. caven, A. aroma*			Arg-12,Uru Par	Trunk, limbs	
Chrysomelidae													
**Acanthonycha* sp. or nr.	CD				1				1/100sw	1	Arg-1		A
Babia elongata J. Guerin	CD	1							1/3b	1	Arg-1		A
	V	X	X					*A. caven*			Arg-9		
Chrysodina semiaurata Lefev.	W						X				Arg,Braz		
C. sp.	CD			1					1/2b	1	Arg-1		A
Colaspis sp. nr. *concoloripes* Bechyne	W	X		X							Arg		
C. lebasi Lefv.	W						X	*Pithecellobium, A. farnesiana*			Arg,C.Am.		
C. varia Lefv.	CD			2					2/3b	1	Arg-1		A
	B							Several cultivated plants (Rosaceae)			Arg-6,Uru, Braz		A
C. sp.	CD			2	3				4/230sw,1/3b	3	Arg-3		A
Coscinoptera argentina Burm.	V	X	X					*A. caven*			Arg-3,Uru	Leaves	A
C. dubia L. Guerin	V	X	X					*A. caven*			Arg-3	Leaves	A
Cryptocephalus sp.	W		X	X							Arg		
**Cylindrodachrys cleroides* Monrós	V	X	X					*A. caven*			Arg-4,Par	Leaves	A

See footnotes at end of table.

Table 1
Phytophagous insects collected from *Prosopis* spp. in Argentina and Paraguay from 1976 to 1981, and reported by other workers—Continued

Insect name	Data source[1]	Prosopis species and No. of insects collected[2] — Series Chilenses: *nigra*	*alba*	*chilensis*	*flexuosa*	*alpataco*	*caldenia*	*affinis*	*ruscifolia*	*strombulifera*	Other named species[3]	Un-ident. spp.	Host species in other genera[4]	Abundance (No. insects/ collection method)[5]	No. sites where coll.	Country and No. of Prov. where collected[6]	Attack site or mode	Stage coll.[7]
Dachrys nr. *signatipennis* Lac.	CD		2							1			*A. caven*	3/300sw	3	Arg-3		A
	B,H												*Piptadenia macrocarpa*, *A. aroma*			Arg-1,Braz	Leaves	A
D. willinki Monrós	CD	3					1							3/50sw,1/3b	2	Arg-2		A
D. spp. a–c	CD	2					2					2		6/80sw	4	Arg-3		A
Dinophtalma spp. a,b	CD							2						2/400sw	1	Arg-1		A
Epithrix sp.	CD		1											1/100sw	1	Arg-1		A
Glyptoscelis gigas Jac.	W											X				Arg,Braz		
G. planigera Blake or nr.	DC	1						1	2				*Parkinsonia*	4/350sw	3	Arg-3		A
G. sp.	CD							3	2					5/200sw	3	Arg-2		A
Homotypus sp.	CD	3												3/50sw	1	Arg-1		A
Ischiopachys cribripennis Lac.	B,V	X	X										*A. caven*, *A. aroma*			Arg-10,Braz, Par,Uru		
I. micans Lac.	CD						3							3/100sw	1	Arg-1		A
	B,H											X	*A. aroma*			Arg-8,Uru	Leaves	A
Megalostomis nr. *bubalus* Lac.	CD		1											1/100sw	1	Arg-1		A
M. sp. nr. *consimilis* Achard	V	X	X													Arg-11,Bol, Par	Leaves	A
M. gazella Lac.	H,W,V	X	X									X	*A. caven*, *A. aroma*			Arg-15,Braz, Bol,Chi,Par, S.Am		
M. prob. *gazella* Lac.	CD	1					1						*Sesbania*	1/100sw,1/3b	2	Arg-2		A
Metachroma sp.	CD	1												1/30sw	1	Arg-1		A
Metallactus inustus Stuff. or nr.	CD	1					1							1/100sw	1	Arg-1		A
M. spp.	V	X	X										*A. caven*			Arg-3	Leaves	A
M. sp.	CD						1						*A. caven*	1/30sw	1	Arg-1		A
Monolepta sp.	CD	1												1/50sw	1	Arg-1		A
Nodonota ? sp.	CD		1						1					2/2h	2	Par, Braz		A
Pachybrachis nr. *adspersa* Stuff.	CD	3					6						*A. caven*	1/3b,8/110sw		Arg-2		A
P. nr. *aegrotans* Stuff.	CD					3								3/30sw	1	Arg-1		A
P. nr. *signifer* Stål.	W						X									Arg		
P. spp.	V	X	X										*A. caven*			Arg-2	Leaves	A
P. spp. a–i	CD	3	2	5	5			3	2	5				4/6b, 21/1500sw	18	Arg-8		A

Paria sp.	CD								3					3/30sw	1	Arg-1		A
Phaedon semimarginatum Latr.	CD							29					*Grindelia* sp.	29/200sw	1	Arg-1		A
	W						X									Arg,Braz,Peru		
Saxinis meridionalis Monrós	V											X	*A. caven, A. aroma*			Arg-10		
nr. *Schizonoda* sp.	CD	2						1						3/250sw	2	Arg-2		A
nr. *Stereonoda* sp.	CD		1											1/10	1	Arg-1		A
**Temnodachrys* (s.st.) *aenofasciata* (Lac.)	V	X	X													Arg-17,Uru Par	Leaves	A
**T.* (s.st.) *signatipennis* (Lac.)	V	X	X										*A. caven, A. aroma*			Arg-11,Uru, Bol,Par	Leaves	A
**T. willinki* Monrós	H,V	X	X										*A. caven*			Arg-8	Leaves	A
Urodera duplicata Monrós	CD								1					1/0.5h	1	Arg-1		A
	W,V	X	X								*rub*		*A. caven*			Arg-9	Leaves	A
U. fallaciosa Monrós	V	X	X										*A. caven*			Arg-4		A
U. fallax Har.	CD						3		1					3/200sw	2	Arg-2		A
	B												*Sesbania punicea*			Arg-2	Leaves	A
U. hamatifera Lac.	CD	1	1					2						4/250sw	3	Arg-2		A
	H,W,V	X	X									X	*A. caven*			Arg-14,Col	Leaves	A
U. sp.	CD								1					1/0.5h	1	Arg-1		A
Cucujidae																		
Scalidia ignota (Grouv.)	V	X										X				Arg-3	Dead bark	
Curculionidae																		
**Acyphus funicularis* Heller	CD	1						2					*Parkinsonia*	1/100sw,2/1h	2	Arg-2		A
	V	X	X						X				*A. caven*			Arg-4, Uru	Leaves	A
**Alloxycorynus bruchi* (Heller)	CD				1									1/1h	1	Arg-1		A
Apion prosopidis Kieff.&Jörg.	J,B,V	X	X			X										Arg-3	Leaf petiole gall	
A. spp.	CD	67	16	34	55	7	20	83	12		*arg-6 vin-4*		*A. caven, A.* sp., *Geoffroea decorticans, Zuccagnia, A. aroma, Aloysia gratissima*	266/2360sw, 32/22b	34	Arg-12,Par	Leaves	A
	W,V	X	X						X				*A. caven*			Arg-2	Leaves	A
A. sp.	CD	5			230	11		1						247/3h	6	Arg-5	Seed	L,P
	E											X				Arg	Seed	
**Apocnemidophorus* sp.	CD									3				3/100sw	1	Arg-1		A
Baris sp.	CD		1											1/0.5h	1	Par		A
Cratosomus helleri Emden	CD								1				*Cassia aphylla*	1/0.5h	1	Arg-1		A
	B,CL, H,V	X	X										*Cassia aphylla Bulnesia* sp., *Cercidium* spp., *Citrus* sp., *Eucalyptus* spp.			Arg-5, Braz, Bol	Stem	
C. fasciatopunctatus Guérin	V	X	X									X	*A. caven*		1	Arg-9,Bol		A

See footnotes at end of table.

Table 1
Phytophagous insects collected from *Prosopis* spp. in Argentina and Paraguay from 1976 to 1981, and reported by other workers—Continued

Insect name	Data source[1]	Prosopis species and No. of insects collected[2] — Series Chilenses: *nigra*	*alba*	*chilensis*	*flexuosa*	*alpataco*	*caldenia*	*affinis*	*ruscifolia*	*strombulifera*	Other named species[3]	Un-ident. spp.	Host species in other genera[4]	Abundance (No. insects/ collection method)[5]	No. sites where coll.	Country and No. of Prov. where collected[6]	Attack site or mode	Stage coll.[7]
Diorymerus sp.	CD		1											1/100sw	1	Arg-1		A
**Enoplopactus brunneo-maculatus* Hust.	CD	1												1/0.5h	1	Arg-1		A
Erodiscus sp.	CD							1						1/3b	1	Par		A
Hadromeropsis argentinensis (Hust.)	B,V		X										*A. caven*			Arg-4,Uru	Leaves	A
Hypocoeliodes sp.	CD		1											1/100sw	1	Arg-1		A
**Naupactus bruchi* Heller	V	X							X							Arg-3		
**N. calamuchitensis* Hust.	CD						5							1/30sw,4/3b	2	Arg-2		A
	V		X										*A. caven*			Arg-1	Leaves	A
**N.* nr. *cyphoides* Heller	CD							1			*vin*-1			1/1h,1/3b	2	Par		A
	B,W,V	X	X									X	*A. caven*, *Medicago*			Arg-4,Bol	Leaves	A
**N. rugipennis* Hust.	CD				9									8/1h,1/3b	2	Arg-2		A
**N. sulphuriferus* Pascoe	CD	1		3		1					*toq*-1		*Larrea cuneifolia*, *L. divaricata*	6/9b	3	Arg-2		A
	V												*A. caven*, *Larrea* spp.			Arg-4	Leaves	A
**N. viridimicans* Hust.	B,W											X				Arg,Bol	Leaves	A
**N. viridinites* Hust.	V	X	X										*A.caven*			Arg-2	Leaves	A
Pandeleteius platensis Breth.	CD	7		2			21							26/21b, 4/80sw	10	Arg-3		A
P. sp.	CD	3					5	1						1/1h	1	Par		A
Pantomorus spp. *a*–d	CD					5								5/100sw	4	Arg-2		A
Paraceratopus sphaeralceae Breth. (prob. = *Macrorhoptus sphaeralciae* Pierce)	CD							6					*Sphaeralcea* sp.	6/200sw	1	Arg-1		A
Platyomus planicollis Hust.	V		X									X	*A. caven*			Arg-2	Leaves	A
**Pororrhynchus albolateralis* Hust.	CD	16												10/130sw, 5/2h	2	Arg-1		A
	V	X	X				X					X	*A. caven*			Arg-3,Bol	Leaves	A
**P. labeonis* Fahraeus	CD		4					25	2				*A. caven*	29/300sw, 2/1h		Arg-3		A
	V	X	X										*A. caven*			Arg	Leaves	A
**P.* spp. *a*–k	CD	5	5	1	7		13	15	21	11	*toq*-1, *vin*-5, *ela*-1, *fie*-1, *has*-1		*A. caven*	36/740sw, 47/40b	28	Arg-8,Par		A

P. n. spp. a–e	CD	7	11				31	12		54			*A. caven*, *A. aroma*	84/1050sw, 31/7b	13	Arg-7		A
Promecops spp. a–d	CD	2	1				2		22		*has*-1, *vin*-3		*A. caven*	24/450sw, 7/3h	6	Arg-3,Par		A
*Promecopini n. gen n. sp.	CD	1										2	*Larrea divaricata*	3/3b	2	Arg-2		
**Rhigopsidius tucumanus* Heller	CD B,H	2								1			*Solanum pocote*, *S. tuberosum*	1/100sw,2/3b	2	Arg-2		A
																Arg-5,Chi, Bol,Peru	Root	L
Sibinia algarobilla n. sp. Clark	CD										*ser*-5			5/50sw	1	Arg-1	Bud	A
S. asulcifera Clark	CD				1						*arg*-1, *toq*-1			3/100sw	3	Arg-1	Seed	A
S. concava Clark	CD	1			5									6/450sw	5	Arg-4	Bud	A
S. mastuerzo n. sp. Clark	CD									18				18/100sw	1	Arg-1	Seed	A
S. tintitaco n. sp. Clark	CD										*toq*-14			14/150sw	2	Arg-2	Bud	A
†*Sitophilus granarius* (L.)	CD CL		1										Stored seeds of several cereals	1/1h	1	Arg-1 Cosmopolitan	Seed	L
**Wagneriella alba* Hust.	CD		3						14	3			*A. caven*, *A. aroma*	20/650sw	7	Arg-4		A
**W. lineata* Hust.	V	X	X						X				*A. caven*			Arg-5,Bol	Leaves	A
**W.* sp.	CD								1					1/3b	1	Par		A
Dermestidae																		
Attagenus sp.	CD			2		1								3/170sw	2	Arg-2		A
Cryptorhopalum sp.	CD				1								*Aloysia gratissima*	1/100sw	1	Arg-1		A
Trogoderma sp.	CD					2					arg-1			3/170sw	2	Arg-2		A
Elateridae																		
Conderus malleatus Ger.	CD CL,H	2											*Psidium guajava*, *Prunus* sp., *Pyrus malus*, *Eucalyptus* sp., *Ipomoea batatas*, grasses	2/100sw	1	Arg-1	Fruit	A L,A
C. rufangulus (Gyll.)	W											X				Arg,Braz,Uru		
Horistonotus nr. *spernendus* Er.	CD			1										1/2b	1	Arg-1		A
Languriidae																		
Hapalips sp.	CD						2						*A. caven*	2/1h	1	Arg-1	Seed	L
Lyctidae																		
Trogoxylon ingae Santoro	V	X														Arg-11	Stem	A
Meloidae																		
Epicauta adspersa (Klug)	W											X				Arg,Uru		A
E. atomaria (Germar)	CD B,H	3											*Nicotiana* sp., *Solanum* spp., *Lycopersicon*, *Capsicum*	3/1b	1	Arg-1		A
																Arg-10	Leaves	A
E. sp.	CD								4					4/3b	1	Par		A

See footnotes at end of table.

Table 1
Phytophagous insects collected from *Prosopis* spp. in Argentina and Paraguay from 1976 to 1981, and reported by other workers—Continued

		Prosopis species and No. of insects collected[2]																
		Series Chilenses																
Insect name	Data source[1]	*nigra*	*alba*	*chilensis*	*flexuosa*	*alpataco*	*caldenia*	*affinis*	*ruscifolia*	*strombulifera*	Other named species[3]	Un-ident. spp.	Host species in other genera[4]	Abundance (No. insects/ collection method)[5]	No. sites where coll.	Country and No. of Prov. where collected[6]	Attack site or mode	Stage coll.[7]
Melyridae																		
nr. *Amecocerus* spp. a–c	CD			7	17	2				1				27/540sw	6	Arg-4		A
Astylus sp.	CD						1							1/1h	1	Arg-1		A
Attalus sp.	CD				1									1/100sw	1	Arg-1		A
Collops sp.	CD										*has*-1			1/1h		Par		A
Mordellidae																		
Mordella sp.	CD						1							1/1h	1	Arg-1		A
Mycteridae																		
Polypria sp.	CD								2					2/3b	1	Par		A
Nitidulidae																		
†*Carpophilus hemipterus* (L.)	W											X				Arg,Chi,Mex, C.Am,N.Am, Europe		
C. humeralis (F.)	CD	1												1/1h	1	Arg-1	Seed	L
Lobiopa sp.	W		X													Arg		
nr. *Platychora*	CD				1									1/1h	1	Arg-1		A
Soronia nr. *rectangula* Reitt.	CD				1									2/1h	1	Arg-1		A
Ptinidae																		
Ptinus sp.	CD				1		1							1/3b,1/70sw	2	Arg-2		A
Scarabaeidae																		
Euphoria spp.	B,W											X				Arg		
**Homonyx chalcea* Blanchard	B,W											X				Arg		
**H. chalcea* var. *fuscocupreus* Ohaus	B,V	X	X									X				Arg-3		
Tenebrionidae																		
**Epitragus aurulentus* Kirsch	CD							1						1/2b	1	Par		A
**E. similis* Steinh.	CD	1		1				1						3/6b	3	Arg-2,Par		A
	B,H,V	X	X										*A. caven*, *Condalia*, *Gossypium* sp.			Arg-9,Bol		L
**E.* sp. nr. *similis* Steinh.	CD	1					7							8/7b	3	Arg-1		A
**E.* sp.	CD	3											*Larrea cuneifolia*	3/30sw	1	Arg-1		A
**Hemasodes* sp.	CD						1						*Larrea cuneifolia*, *L. divaricata*	1/2b	1	Arg-1		A
**Omopheres bacchulus* Berg	CD				2		3							5/5b	2	Arg-2		A
	W											X				Arg		

*O. spp. a,b	CD	3		6					1	*Lippia* sp., *Larrea divaricata*, *L. cuneifolia*	1/2b	1	Par		A
Strongylium sp.	CD					1					1/2b	1	Par		A
**Thinobatis* sp.	W							*rub*					Arg		
Trogostitidae											1/100sw	1	Arg-1		A
nr. *Eronyxa* sp.	CD			1									Arg		
Tenebroides sp.	W				X										
Diptera															
Agromyzidae											1/150sw	1	Arg-1		A
Melanagromyza sp.	CD	1											Arg		
Phytobia sp.	W								X						
Anthomyiidae											2/200sw	1	Arg-1		A
Craspedochaeta punctipennis (Wied.)	CD					2									
Delia platura (Meigen)	CD	5			1						6/230sw	3	Arg-2		A
	CL									*Asparagus* sp., *Allium cepa*			Bol		L
Cecidomyiidae															
**Liebelicla prosopidis* (Kieffer & Jörgensen)	J						X						Arg-2	Branch gall	
Neolasioptera graciliforceps (Kieffer and Jörgensen)	J						X						Arg-2	Twig gall	
Rhopalomyia prosopidis (Kieffer & Jörgensen)	J				X			*cam*					Arg-2	Gall	
**Tetradiplosis sexdentatus* (Kieffer & Jörgensen)	J	X			X			*cam*					Arg-2	Branch and thorn gall	
Chloropidae											1/200sw	1	Arg-1		A
Chlorops n. sp.	CD					1					16/200sw	2	Arg-2		A
C. mendozae Mall.	CD	15		1							2/100sw	1	Arg-1		A
C. nr. *mendozae* Mall.	CD					2					1/50sw	1	Arg-1		A
Conioscinella sp.	CD			1									Arg		
	W	X							X				Arg		
Elachiptera sacculicornis (End.)	W	X													
Liohippelates aequatorialis (Becker)	CD	4			1						4/50sw,1/3b	2	Arg-2		A
L. n. sp.	CD								1		1/50sw	1	Arg-1		A
L. sp.	CD			1							1/50sw	1	Arg-1		A
Olcella sp.	CD			1							1/50sw	1	Arg-1		A
	W								X				Arg		
Oscinella sp.	W	X											Arg		
Empididae											7/70sw	1	Arg-1		A
Drapetis sp.	CD			7											
Lonchaeidae											5/200sw	2	Arg-1		A
Dasiops sp.	CD		2	3											

See footnotes at end of table.

Table 1
Phytophagous insects collected from *Prosopis* spp. in Argentina and Paraguay from 1976 to 1981, and reported by other workers—Continued

Insect name	Data source[1]	Prosopis species and No. of insects collected[2] — Series Chilenses: *nigra*	*alba*	*chilensis*	*flexuosa*	*alpataco*	*caldenia*	*affinis*	*ruscifolia*	*strombulifera*	Other named species[3]	Un-ident. spp.	Host species in other genera[4]	Abundance (No. insects/ collection method)[5]	No. sites where coll.	Country and No. of Prov. where collected[6]	Attack site or mode	Stage coll.[7]
Tephritidae																		
Euaresta bullans (Wied.)	CD	1												1/150sw	1	Arg-1		A
E. sp.	CD	1					2							1/50sw,2/3b	2	Arg-2		A
Tomoplagia heringi Aczel	W	X														Arg		
T. sp.	CD							1						1/200sw	1	Arg-1		A
Trupanea sp.	CD				1									1/100sw	1	Arg-1		A
†*T. mevarna* (Walk.)	W											X				Arg,USA		A
Hemiptera																		
Coreidae																		
†*Leptoglossus phyllopus* (L.)	W											X				Arg,USA		
**Pachylis argentinus* Berg	W											X				Arg		
Lygaeidae																		
Lygaeus alboornatus Blanchard	W											X				Arg,Bol,Chi, Par,Braz, Peru,Uru	Seed	
Miridae																		
Certacapsus sp.	CD	1	1	2				3						5/350sw,2/2b	4	Arg-3		A
**Haarupia spinosa* Poppius	CD	1												1/50sw	1	Arg-1		A
	W	X					X									Arg		
**H.* sp.	W						X									Arg		
Orthotylus sp.	W	X	X				X									Arg		
Phytocoris sp.	W	X					X				*rub*	X				Arg,Mex		
Pentatomidae																		
Acledra sp. (?)	W											X				Arg		
**Lobepomis peltifera* Berg	CD	3		3			1							1/100sw, 6/10b	4	Arg-3	Seed	A
	W	X														Arg		
†*Oebalus pugnax* (F.)	W										*gld*	X	Rice			Arg-4,USA, Mex		
Thyanta aeruginosa Berg	W	X														Arg		
T. elegantula Haar	W											X				Arg		
Rhopalidae																		
Arhyssus sp.	W	X														Arg		
Harmostes imitabilis Harris	W											X				Arg		
H. sp.	CD								1					1/100sw	1	Arg-1		A
Liorhyssus sp.	W											X				Arg		

Thyreocoridae																	
Pericrepis afer McAtee & Malloch	CD				2									2/1b	1	Arg-1		A
Homoptera																	
Cercopidae																	
Aphorphora sp.	CD						1							1/200sw	1	Arg-1,N.Am		A
Cephisus siccifolius (Walker)	W,H						X				X	Numerous hosts			Arg,C.Am, Mex		
Deois incompleta (Walker)	W										X				Arg,Braz		
D. knoblauchii (Berg)	W										X	Sugarcane			Arg,Braz		
Cicadellidae																	
Empoasca sp.	W	X													Arg,N.Am		
Exitianus obscurinervis (Stål)	W										X				Arg,C.Am, Mex		
Gypona paupercula Spanberg	CD	33	5	3	1	7	4					*A. caven, Acacia*	23/810sw		Arg-8		A
	W	X				X	X								Arg,Uru		
†*Menosoma cincta* (Osborn & Ball)	W									*gld*	X				Arg,Braz,Bol, N.Am,Par		
Paratanus sp.	W	X													Arg		
Polana obliqua DeLong & Freytag	CD						2		32				14/500sw	4	Arg-4		A
Tapajosa doeringi (Berg)	CD	27				1							1/50sw,1/3b	2	Arg-2		A
	W										X				Arg		
Cixiidae																	
Oliarus spp.	CD							1					1/100sw	1	Arg-1		A
	W									*rub*					Arg		
Coccidae																	
Ceroplastes sp.	CD			80									80/1h	1	Arg-1	Stem	A,N
Ophisthoscelis prosopidis[9] Kieffer & Jörgensen	J,H,W									*toq*					Arg-2	Branch gall	
Protargionia larreae Leonardi	H,W	X	X									*Bulnesia retama*			Arg		
Flatidae																	
"*Ormenis*" sp.	CD		1									*Parkinsonia, Acacia, Larrea divaricata*		1	Arg-1		A
Issidae																	
Hysteropterum sp.	CD	22										*Larrea divaricata*	1/50sw	1	Arg-1		A
Thionia sp.	CD	1											1/3b	1	Arg-1		A
Membracidae																	
Ceresa ustulata Fairmaire	CD						3					*A. caven*	3/200sw	1	Arg-1		A
C. sp.	CD		1							*vin-1*			1/100sw,1/2b	2	Arg-1,Par		A
Darnis sp.	CD	1		1									2/3b	2	Arg-2		A
Enchenopa sp.	CD			3								*A. caven*	3/100sw	1	Arg-1		A
	W	X									X				Arg		
Entylia gemmata (Germar)	W										X				Arg,S.Am, Mex		

See footnotes at end of table.

Table 1
Phytophagous insects collected from *Prosopis* spp. in Argentina and Paraguay from 1976 to 1981, and reported by other workers—Continued

Insect name	Data source[1]	Prosopis species and No. of insects collected[2] — Series Chilenses: *nigra*	*alba*	*chilensis*	*flexuosa*	*alpataco*	*caldenia*	*affinis*	*ruscifolia*	*strombulifera*	Other named species[3]	Un-ident. spp.	Host species in other genera[4]	Abundance (No. insects/ collection method)[5]	No. sites where coll.	Country and No. of Prov. where collected[6]	Attack site or mode	Stage coll.[7]
**Hebetica arechavaeleta* (Goding)	CD	12	2	2	1	1	2	5						25/1250sw	16	Arg-7		A
**H. limacodes* (Burmeister)	CD	1							1					2/150sw	2	Arg-2		A
**Nassunia bipunctata* (Fairmaire)	CD		1											1/100sw	1	Arg-1		A
**Smiliorachis* nr. *concinna* Stål	CD		11					3						14/200sw	2	Arg-1		A
**S. proxima* Berg	CD	9	2	1	1			5						18/820sw	8	Arg-6		A
	H,W	X											*A. caven, Mimosa*			Arg,Braz, Col,Uru		
Stictopelta acutula (Fairmaire)	CD	2	2	1	11									16/320sw	4	Arg-4		A
	CL												Solanaceae			Braz		
S. flaviceps (Burmeister)	CD				1									1/100sw	1	Arg-1		A
	W	X														Arg,Braz, Ecu,Uru		
S. indeterminata (Walker)	CD	6	7	1	3			25	4	4			*Acacia aroma, A. caven, A.* sp.	50/1270sw	14	Arg-6		A
	W											X	*Acacia* sp.			Arg,C.Am,Mex		
**Sundarion apicalis* (Germar)	CD	1							1				*A. caven*	2/150sw	2	Arg-2		A
Psyllidae																		
Euphalerus sp.	W	X	X				X					X				Arg		
nr. *Euphalerus* spp. *a*–d	CD	53	29	3	22	4	1			3	*toq*-1			7/5b, 109/1200sw	19	Arg-5		A
Hymenoptera																		
Cynipidae																		
**Eschatocerus myriadeus* Kieffer & Jörgensen	CD	X												100+branches on each tree infested and killed	2	Arg-2	Branch gall	L,P
	J					X					*cam*					Arg-1	Branch gall	
**E. niger* Kieffer & Jörgensen	J,H,W	X	X			X					*cam*					Arg-2	Branch gall	
**E.* sp.	CD				X											Arg-1	Branch gall	A

Pergidae																		
Brachyphatnus sp.	R			83										100%[8]		Arg	Leaves	
Lepidoptera																		
Cosmopterigidae																		
Genus and spp. a, b	CD							1	3					1/100sw,3/1h	2	Arg-2	Leaf tier	L
Gelechiidae																		
Aristotelia sp.	CD										*toq*-4			4/1h	1	Arg-1	Leaf tier	L,P
Evippe ? sp.	CD	38			7			15	18		*vin*-3			81/6h	6	Arg-3	Leaf tier	L,P
Recuvaria sp.	CD										*toq*-1			1/1h	1	Arg-1	Leaf tier	L
Recuvaria or *Aristotelia* sp.	CD	32	28					4			*ela*-2, *has*-7, *toq*-6, *vin*-1	12		92/12h	12	Arg-4,Par	Leaf tier	L,P
Geometridae																		
Iridopsis sp. or spp. nr. *ustifumosa* Warren[9]	CD			1			1	1		1				1/50sw,1/3b 2/3h	5	Arg-3,Par	Leaf tier	L,P,A
**Narragodes* prob. *gyda* Prout	CD			10			1							10/2h,1/3b	2	Arg-2	Leaf tier	L,P,A
**Nephodia marginata* (Warren)	W,O,H	X	X									X				Arg	Leaves	L
Semiothisa nr. *armigerata* (Guenée)	CD				1									1/100sw	1	Arg-1	Leaves	A
S. sp.	R			61	23						*toq*-653		*A. aroma*, *A. furcatispina*, *Cercidium*	64%[8]		Arg	Leaves	
**Synneuria alba* (Bt. Calv.)	CD										*cag*-1			1/60sw	1	Arg-1	Leaf tier	L
Genus and spp. a–q	CD	7	4		3	2	12	8		1	*arg*-2, *toq*-2			29/1900sw, 3/12b	9	Arg-9	Leaves	L
Hesperiidae																		
Sarmientoia faustinus (Burmeister)	H	X														Arg		
S. haywardi Mielke	H	X														Arg		
Lasiocampidae																		
Tolype guentheri (Berg)	W,H	X	X										*Ziziphus* sp., *Acacia* spp., *Boehmeria caudata*, *Salix* sp., *Populus* sp.			Arg	Leaves	L
T. viuda Schaus	W,H	X	X									X	*A. caven*, *Geoffroea decorticans*, *Mimosa hexandra*, other legumes			Arg	Leaves	L
T. sp.	CD											4		4/2h	1	Arg-1		A

See footnotes at end of table.

Table 1
Phytophagous insects collected from *Prosopis* spp. in Argentina and Paraguay from 1976 to 1981, and reported by other workers—Continued

Insect name	Data source[1]	Prosopis species and No. of insects collected[2] — Series Chilenses: *nigra*	*alba*	*chilensis*	*flexuosa*	*alpataco*	*caldenia*	*affinis*	*ruscifolia*	*strombulifera*	Other named species[3]	Un-ident. spp.	Host species in other genera[4]	Abundance (No. insects/ collection method)[5]	No. sites where coll.	Country and No. of Prov. where collected[6]	Attack site or mode	Stage coll.[7]
Lycaenidae																		
Ministrymon sp.	Rob											X				Arg		
Strymon eurytulus (Hbn.)	CD								1					1/50sw	1	Arg-1		A
Megalopygidae																		
Norape spp. a,b	CD		2					1						3/300sw	2	Arg-2		L
**Podalia nigricostata* Dognin	H	X	X										*Acacia* spp., *Neptunia* sp., *Robina*, *Tipuana* sp., *Geoffroea* sp., *Mimosa* sp.			Arg	Leaves	L
Noctuidae																		
†*Ascalapha odorata* (L.)	H,B											X	*Piptadenia*, *Pterogyne*, *Cassia*, *Acacia* spp., *Ginga* sp.			Arg,Uru,USA		
Melipotis bisinuata (Felder & Rogenhoefer)	R			61	242								*A. aroma*	96%[8]		Arg	Leaves	
Noctuidae sp. *a*	R			29										100%[8]		Arg		
Selenisa suero (Cramer)	W,H											X				Arg		
†*S. sueroides* (Guenée)	CD		1										*Sesbania exarferata*	1/1h	1	Arg-1, USA		L
Oecophoridae																		
Cecidolechia maculicostella Strand	J,H		X			X					*cam*					Arg-2	Flower gall	L
Psychidae																		
Oiketicus bergii (Weyenbergh)	CD	10		53	75		10						*A. aroma*, *Larrea*, *Cercidium*, *Mimozyganthus*			Arg-4	Leaves	L,A
	W									X		X	*C. aphylla*			Arg	Leaves	
O. geyeri Berg	R			X	X								*A. aroma*, *Mimosa*, *Cercidium*	67%[8]		Arg	Leaves	
O. horni Koehler	W											X				Arg	Leaves	
O. westwoodii Berg	W											X	*Piptadenia* spp.			Arg	Leaves	

Pyralidae																		
Anypsipyla univitella Dyar	CD			10	2	3					*kun*-7, *abb*-1, *fie*-2		25/10h	11	Arg-5,Par	Seed	L,P,A
	CL											*Enterolobium timbouva*, *Cassia brasiliensis*			Braz,Mex	Seed	L
†*Cadra cautella* (Walker)	CD	5	15	2	7	1	1		10		*arg*-2, *kun*-1, *toq*-2		5/3b,41/8h	10	Arg-8		L
	CL											Stored grains, numerous genera			Cosmo-politan		
†*Ectomyelois ceratoniae* (Zeller)	CD			2							*kun*-6	*A. caven*, Erythrina cristagalli,	8/3h	3	Arg-2	Seed	L,P
	W										*jul*	*Acacia*, *Caesalpinia*, *Haematosylum*, *Samanea*			Cosmo-politan	Seed, fruit	
†*Pyralis farinalis* L. (prob.)	CD										*kun*-1		1/1h	1	Arg-1	Seed	L
	CL,H											Stored grains			Cosmo-politan		
Saturniidae																	
Adelocephala sp.	CD						2						2/3b	1	Arg-1		L
Automeris aspera (Felder)	H,Bi,W	X	X					X				*Acacia* spp., *Aspidosperma* sp., *Celtis* sp., *Mimosa* spp., *Tamarix* sp.			Arg,Uru,Braz, Par		
A. oberthuri (Boisduval)	H,W	X	X												Arg	Leaves	L
Citheronia sp.	CD										*ser*-1		1/50sw	1	Arg-1		L
Hylesia sp.	CD						1						3/lb	1	Arg-1	Leaves	L
Sphingicampa lineata (Dognin)	W,H	X	X									*A. aroma*			Arg		L
Syssphinx formosa Dognin	W,J									X					Arg		
Sesiidae																	
Sesia sp.	CD		1										1/1h	1	Arg-1	Twig gall	L
Synanthedon sp. nr. *sciophilaeformis*	CD				1								1/1h	1	Arg-1	Twig gall	L
Tortricidae																	
**Cryptophelebia carpophagoides* Clarke	CD		1					1					2/2h	2	Arg-1,Par	Seed	L
Cydia sp.	CD			9									9/2h	1	Arg-1	Twig gall	L

See footnotes at end of table.

Table 1
Phytophagous insects collected from *Prosopis* spp. in Argentina and Paraguay from 1976 to 1981, and reported by other workers—Continued

Insect name	Data source[1]	Prosopis species and No. of insects collected[2]: Series Chilenses: *nigra*	*alba*	*chilensis*	*flexuosa*	*alpataco*	*caldenia*	*affinis*	*ruscifolia*	*strombulifera*	Other named species[3]	Un-ident. spp.	Host species in other genera[4]	Abundance (No. insects/ collection method)[5]	No. sites where coll.	Country and No. of Prov. where collected[6]	Attack site or mode	Stage coll.[7]
Genus and sp. a	CD				1									1/1h	1	Arg-1	Twig gall	L
Genus and sp. b	CD						1	7						8/1h	2	Arg-2	Twig gall	L
Thysanoptera																		
Thripidae																		
Frankliniella rodeos Moulton	E,W											X				Arg,Chi	Flower	
Acarina																		
Eriophyidae																		
Eriophyes poss. *tenuis* (Nal.)	CD									1				Many	1	Arg-1	Leaves	A,N

[1]B = Bosq (*1943*); Bi = Biezanko et al. (*1957*); CD = Cordo and DeLoach (or Cordo alone or with Ferrer); CL = Costa Lima (*1968*); E = Erb; H = Hayward (*1958*); J = Jörgensen (*1916*); K = Kingsolver et al. (*1977*), Kingsolver (*1968*, *1982*, *1983*), L'Argentier and Kingsolver (*1984*); O = Orfila (*1966*); R = Cates and Rhoades (*1977*); Rob = R.K. Robbins (pers. comm.); V = Viana; W = Ward et al. (*1977*).

[2]X indicates occurrence on a given species of mesquite reported by other authors who did not give numbers collected or indication of abundance; numbers are total number of specimens we collected.

[3]Species of *Prosopis: abb* = *abbreviata*, *arg* = *argentina*, *cag* = *calingastana*, *cam* = *campestris*, *ela* = *elata*, *fer* = *ferox*, *fie* = *fiebrigii*, *gld* = *glandulosa*, *has* = *hassleri*, *hum* = *humilis*, *jul* = *juliflora*, *kun* = *kuntzei*, *pan* = *alba* var. *panta*, *rep* = *reptans*, *rub* = *rubriflora*, *ser* = *sericantha*, *toq* = *torquata*, *vin* = *vinalillo*.

[4]*A.* = *Acacia*, *C.* = *Cassia*.

[5]b = number of sheets by beating, h = hours searching by hand, sw = number of sweeps

[6]Arg = Argentina, Braz = Brazil, Bol = Bolivia, C.Am = Central America, Chi = Chile, Col = Colombia, Ecu = Ecuador, Mex = Mexico, N.Am = North America, Par = Paraguay, S.Am = South America, Uru = Uruguay, USA = United States.

[7]A = adult, L = larva, N = nymph, P = pupa.

[8]Percent preference scores of feeding on *Prosopis* spp. among all plants examined (Cates and Rhoades 1977).

[9]Genus given does not occur in North America; however, taxonomic revision would probably reveal that this species should be placed in another genus (taxonomists of the USDA–ARS Systematic Entomology Laboratory, pers. comm.).

*Signifies that the insect genus is not represented in North America; †indicates that the insect species occurs in North America, according to taxonomists of the USDA–ARS Systematic Entomology Laboratory.

Table 2
Priority biological control candidates for mesquite, all of which were collected at several sites and/or are at least moderately abundant

A. Probably specific, cause obvious damage

Coleoptera	
Bruchidae	
Acanthoscelides logiscutus	Seed
_A._ spp. j, k	Seed
*_Pectinibruchus longiscutus_	Seed
*_Rhipibruchus picturatus_	Seed
*_R. prosopis_	Seed
*_R. psephenopygus_	Seed
*_Scutobruchus ceratioborus_	Seed
*_S. curtitropis_	Seed
*_S. terani_	Seed
Cerambycidae	
Achryson lutarium	Large limbs
A. undulatum	Limbs
A. unicolor	Limbs
*_Alphus bruchi_	
*_Calocosmus morosus_	Limbs
*_Criodion cinereum_	Trunk
*_Cyllene spinifera_	
Lochmaeocles sladeni	Girdles lg branches
Odontocera flavicauda	Girdles sm branches
*_Ranqueles mus_	Trunk
Curculionidae	
Apion sp.	Seed
Sibinia asulcifera	Probably seed
S. concava	Probably buds
S. mastuerzo	Probably seed
S. tintitaco	Probably buds
Homoptera	
Psyllidae	
nr. _Euphalerus_ spp. a–d	Foliage
Hymenoptera	
Cynipidae	
*_Eschatocerus myriadeus_	Branches
Pergidae	
Brachyphatnus sp.	Foliage
Lepidoptera	
Gelechiidae	
Evippe spp.	Leaf tier
Recurvaria-Aristotelia sp.	Leaf tier
Geometridae	
*_Narragodes_ sp. prob. _gyda_	Foliage
*_Nephodia marginata_	Foliage
Noctuidae	
Genus and species undet.	Foliage
Psychidae	
Oiketicus horni	Foliage
Acarina	
Eriophyidae	
Eriophyes poss. _tenuis_	Foliage

B. Possibly specific, definite association with Prosopis, damage not obvious, or unknown

Coleoptera	
Anobiidae	
Tricorynus subrutiliceps	Fruit
Cerambycidae	
Leptostylus prob. _phryssomimus_	Pods
Chrysomelidae	
Megalostomis sp. nr. _consimilis_	
Pachybrachis spp.	
*_Temnodachrys aenofasciata_	
Curculionidae	
Pandeleteius platensis	Roots?
*_Pororrhynchus_ spp.	Roots?
Melyridae	
nr. _Amecocerus_ sp. a	
Tenebrionidae	
*_Omopheres bacchulus_	
Hemiptera	
Pentatomidae	
*_Lobepomis peltifera_	Pods
Homoptera	
Cicadellidae	
Polana obliqua	
*_Tapajosa doeringi_	
Membracidae	
*_Hebetica arechavaeleta_	
*_Smiliorachis_ sp. nr. _concinna_	

C. Known to attack other weed genera, cause obvious damage

Coleoptera	
Anobiidae	
Tricorynus argentinus	Fruit
Bruchidae	
*_Scutobruchus vinalicola_	Seed
Buprestidae	
*_Chalcopoecila ornata_	Trunk?
Cerambycidae	
*_Brasilianus lacordairei_	Branches
*_Calocosmus desmaresti_	Limbs and trunk
*_Lopopoeum timbouvae_	Fruit
Oncideres germarii	Small branches
O. guttulata	Limbs
*_Torneutes pallidipennis_	Trunk and lg limbs
Chrysomelidae	
*_Clindrodachrys cleroides_	Foliage
Ischiopachys cribripennis	
Megalostomis gazella	
Pachybrachis nr. _adspersa_	Foliage
Curculionidae	
*_Wagneriella alba_	Roots?

See footnote at end of table.

Table 2
Priority biological control candidates for mesquite, all of which were collected at several sites and/or are at least moderately abundant—Continued

Homoptera	
Cicadellidae	
Gypona paupercula	Leaves or twigs
Membracidae	
Stictopelta inderterminata	Leaves or twigs
Lepidoptera	
Geometridae	
Semiothisa sp.	Leaves
Noctuidae	
Melipotis bisinuata	Leaves
Psychidae	
Oiketicus bergii	Leaves
O. geyeri	Leaves
O. westwoodii	Leaves
Pyralidae	
Anypsipyla univitella	Pods
Thysanoptera	
Thripidae	
Frankliniella rodeos	Flowers

*Signifies that the insect genus is not represented in North America.

Table 3
Amount of damage to *Prosopis* seed by bruchid larvae in field collections

Prosopis species	No. locations	No. seed examined	Percent damaged
flexuosa	7	1,798	24.1
alpataco	4	1,556	7.6
alba	4	698	29.4
nigra	3	600	14.7
chilensis	2	350	32.8
caldenia	6	1,765	35.5
strombulifera	6	1,532	7.5
ruscifolia	1	281	35.9

☆U.S. Government Printing Office : 1987 -720-913/60197